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THE JOURNAL OF APPLIED PSYCHOLOGY

JAMES P. PORTER, *Editor*
OHIO UNIVERSITY ATHENS, OHIO

With a Board of Cooperating Editors
and

PAUL S. ACHILLES HENRY C. LINK
Associate Editors Representing
THE PSYCHOLOGICAL CORPORATION

SOME INTERESTING CONTRIBUTIONS IN THIS ISSUE:

EDWARD L. THORNDIKE, GEORGE H. GALLUP, WALTER V. BINGHAM and WALTER R. MILES. Further Contributions to the Twentieth Anniversary of the Psychological Corporation

HORACE B. ENGLISH. How Psychology Can Facilitate Military Training

CLAUDE E. THOMPSON. Motor and Mechanical Abilities in Professional Schools

WILLIAM M. LEFFLEY. A Comparison of Fraternity and Non-Fraternity Population with Regard to Certain Personality Characteristics

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The Journal of Applied Psychology

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Edited by
JAMES P. PORTER, Ohio University
Athens, Ohio

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HOW PSYCHOLOGY CAN FACILITATE MILITARY TRAINING—A CONCRETE EXAMPLE

HORACE B. ENGLISH
Ohio State University

AT a time when we are all asking how we as psychologists can contribute to our country's defense, an unspectacular but concrete practical example may have its value. After the Armistice of 1918 (and how clearly we now see that it was only Armistice!) a study was undertaken at Camp Lewis of the factors involved in success at rifle shooting. The study (but not the following interpretation) was a cooperative undertaking by Lt. Leo J. Brueckner, Sgt. Scudder (who besides being a psychologist was an expert rifleman), Corp. W. S. Heller and the writer of this note. We were early led to the importance of the so-called "trigger-squeeze" (in contrast with "pulling the trigger") as a central factor.

Recruits are instructed to squeeze the stock of the rifle as well as the trigger, the whole hand participating in the movement as if in squeezing a sponge. Unfortunately, they do not adequately respond to these excellent and clear verbal instructions, nor is it easy for the instructor to determine whether poor results are due to this or to other causes. The problem thus becomes first, one of testing the response and then one of instruction.

We hollowed out the stock of the rifle under the area against which the last three fingers press, or rather should press, in making the proper squeeze. In this space we inserted a rubber bulb and tube. A wooden plate, supported by rather stiff springs, closed over the space so that to casual inspection the rifle was unaltered. The rubber tube led alternatively to a

glass U-tube containing a small amount of a red liquid or to a Marey tambor and kymograph.

The recruit was instructed to shoot in his usual fashion. A proper squeeze depressed the wooden plate and caused a change in the level of the liquid in the U-tube—a rather exaggerated change due to the small bore of the tube. The recruit was thus enabled to compare visually his own squeeze with that of an expert. If his squeeze was inadequate, he continued to practice firing, at first watching the tube, then aiming at a target without watching the tube but informed each time of his squeeze reaction. This continued until he could fire invariably with a proper squeeze.

Excellent results were obtained. Men given up as hopeless by their officers and non-commissioned officers showed rapid improvement in a large percentage of cases. (Others were eliminated because of physiological incapacities, intention tremors, incorrigible unsteadiness, and low intelligence.) Nearly all, after about seven hours drill in the laboratory, were brought up to the minimum standards for efficiency in actual range tests—much to the astonishment of the small arms instructors of their regiment, mostly men from the regular Army.

Report was made to the General Staff of the Army with the enthusiastic endorsement of the Colonel commanding the 1st Regiment, U. S. Army, and the entire experiment was ordered tried out under the auspices of the Section of War Plans. Whatever came of it, the writer has often wondered. He may hazard the guess that it was tried on the basis of a report which was inadequately understood by persons not trained in psychological experimentation, and that it failed. Certainly it would not be the first time that a perfectly good idea had failed in practice because those charged with its execution did not understand what it was all about.

What justifies resuscitating this small experiment after twenty years? The writer originally thought of it as an example of the beneficial effect of knowledge of results. But

the rapid improvement was due to something more than telling the subject the direction of his error. He gained what may be called a local kinesthetic insight into what he is required to do.

The term insight, here used for want of a better, has suffered on the one hand from a quasi-mystical, emotional connotation and on the other from an over-intellectualistic interpretation. Many, probably most, of our useful insights are directly sensory and never become conceptualized at all. We use it as a relatively unanalyzed term, without prejudice to the Gestalt or any other theory of learning, to cover an obvious part of that reorientation of the organism to circumstances which is called learning.

It is not immediately obvious how best to impart such insights. Renshaw and Postle's subjects on the pursuit-meter found verbal tuition a hindrance; they gained a local kinesthetic control freed from visual dominance by the time-tried method of trial-and-error.[1] On the other hand, Carr's subjects learned the stylus maze, in which local kinesthesis is probably less important, better under verbal instruction.[2] In our experiment with the trigger squeeze, putting the subject through his paces seemed highly advantageous. Yet Gates and Taylor[3] who used what seemed closely analogous devices in teaching children to write found them very disadvantageous.

Perplexing as these and other such discrepancies are, it does not seem impossible to formulate a working principle which can be experimentally and practically used. Sound instruction must first discover the particular kind and locus of the insight required for each sort of situation—and by each individual learner. In many bodily skills, this insight is kinesthetic and local, as has long been recognized in practice.

[1] S. Renshaw and D. K. Postle, "Pursuit Learning under Three Types of Instruction." *J. Gen. Psychol.*, 1928, 1, 360–367.

[2] Harvey Carr, "Teaching and Learning," *J. Genet. Psychol.*, 1930, 37, 189–218.

[3] A. I. Gates and G. A. Taylor, "The Acquisition of Motor Control in Writing by Pre-School Children," *Teacher's Coll. Record*, 1923, 24, 459–468.

In our trigger squeeze set-up, we stumbled partly by accident upon just the thing required in the "feel" of the fingers upon the stock; the tracing devices for the teaching of writing were less happy in analyzing out for the learner the necessary elements. In so complicated a task as learning to write, a large measure of cut-and-try is undoubtedly necessary to find just the sensory cues which guide efficient motor response.

Often attainment of insight requires the unlearning of established habits (such as the habit of visual dominance on which Renshaw and Postle laid such stress). At different stages in the progress of complex learning, different kinds of insight are required. With adult humans, a large amount of conceptual insight may be required for certain problems.

The second task of instruction consists in devising conditions which will make this insight as compulsory as possible. Telling recruits to squeeze the stock as if squeezing water from a sponge did "get the idea over" to a certain percentage; it failed with many others, doubtless partly because of stereotyped preconceptions as to how to fire a gun. With Renshaw's pursuit-meter verbal instructions were actually inhibitory. In Laycock's experiments,[4] verbal suggestions were surprisingly ineffective—and yet who, after surveying the results of verbal instruction from the nursery school to the graduate school had a right to be surprised?

At any rate, guided partly by theory, partly by our knowledge of previous studies in learning and partly by *experimentally controlled* trial-and-error, we devised a procedure which for some beginners enormously shortens the time of learning to shoot an army rifle and which makes it possible to train some men who are otherwise marked "untrainable."

Suppose that the saving in training time is only one hour per man—and our experience with the "untrainables" and with uncontrolled samples of other soldiers indicates that we can do much better than save one hour—what does this mean in the training of say a million infantrymen? Yet this is only

[4] S. R. Laycock, *Adaptability to New Situations*, Baltimore: Warwick & York, 1929.

one operation out of literally thousands which are being taught in the various branches of the armed services. In nearly every one there is room for enormous improvement in the techniques of instruction—improvements which would mean millions of precious man-hours saved in bringing men from recruits to fully trained soldiers.

Why then are we as psychologists not hard at work upon these and similar problems? The blunt answer that we have not been invited, indeed not allowed, requires a certain amount of qualification. For it must be remembered that we cannot work out our improvements fairly completely in the laboratory as some of our fellow scientists can. We must ask permission to conduct our experiments with actual soldiers or sailors in training. We cannot say that we have the answers; only that we know how to work to find the answers. We must ask the Services to take us somewhat on faith.

Now it must be admitted that in asking this in the past—in industry and business, where the case parallels the Armed Services—we have been too lacking in faith in ourselves. We have been afraid to give assurance that we can in fact work real improvement in practical situations. Most of us have been trained as scientists—*i.e.*, as seekers after evidence for a truth; and we have learned how cautious one must be who believes to have found it. More cautious far than one who seeks to effect an improvement in a practical situation. Our small experiment in teaching men to shoot illustrates this point well. There will be many who will dispute our interpretation, who will question that our facts are evidence for the principles advanced in their explanation. But what cannot be denied at all is that we took men who could not shoot—who were deemed unteachable—and in a short time made them passable marksmen. We cannot guarantee that an experiment will yield truth but we can be confident in our ability to effect practical improvement—small, sometimes, yet substantial—in the rule-of-thumb methods of imparting training. The time has come actively to seek opportunity to put our talents to work in the service of our country.

FURTHER CONTRIBUTIONS, TWENTIETH ANNIVERSARY OF THE PSYCHOLOGICAL CORPORATION AND TO HONOR ITS FOUNDER, JAMES McKEEN CATTELL

A Few Words

EDWARD LEE THORNDIKE
Former President

I AM proud to be here at this notable anniversary of a successful, and, I believe, beneficent psychological institution.

I was asked to discuss *Current Trends in the Humanistic Sciences.* There is little that is exciting to report, nothing to match the current work of the physical sciences in discovering the constitution of the atoms, or the work of the biological sciences in mapping the chromosomes or in linking living matter to non-living. The youth of scientific method in the sciences of man may be an excuse. But I fear that there is nothing in contemporary economics, sociology or political science to match the work of physics, chemistry and biology in their youth. Our own science of psychology freed itself from domination by theology and philosophy two generations ago only to become dominated by government in this generation in at least two great nations.

I know little about any of the humanistic sciences except psychology, only what I learned in five years in connection with a book that I had to write on *Human Nature and the Social Order.* But it is my impression that the complexity and variability of the facts and the lack of an adequate foundation of psychology have retarded progress. I was especially

impressed with the need of more and better psychology by investigators of the problems of government, of political science. I was proud that psychology through the work of Dr. Link and Dr. Gallup, had started students of government on the road of the measurement of public opinion.

Some of our humble relatives among the lower primates have a better foreign policy and scheme of international relations than science has yet taught man to use. The howler monkeys manage the matter as follows: For the most part, each nation stays in its own territory, minding its own business. If one nation encroaches upon another's territory, the invaded nation meets them with a vigorous attack of howls. The invaders howl back. The contest continues until, by a beneficent provision in the brain of the howler monkey, the side that is outhowled is moved to retire. Not a drop of blood is spilt; not an atom of food or shelter is destroyed. No blot stains the national honor, since each citizen howls his loudest until his inner nature says "Hold! Enough!" or "Howled Enough!" The absolute justice of this procedure is dubious, since there may be a very low correlation between rightful ownership and vociferousness. But the outcomes are surely far better than in man, where the large wins over the small, the bellicose over the peaceful, and force over reason.

It is an elementary principle of psychology that we should not try to dam up and push back the energy and passions of men, but should rather direct and entice them into desirable channels. It has been the world's tragedy of the last half century that effort was not made and ways were not found to encourage the energy and ambitions of the German people and of their rulers toward lines of action that would be good for them and for the rest of the world.

It is perhaps impertinent to suggest that our governments should study psychology. But I can at least recommend that psychologists study government. If we do the work we should do in that field, we may hope to see psychologists attached to the department of state, and the Psychological Corporation consulted regularly by legislators and executives.

Dr. Achilles is to present our tribute to Professor Cattell, but I may be permitted to say that forty-four years ago he became my chosen master—and he still is.

SUMMARY OF PANEL DISCUSSIONS

PANEL I—PUBLIC OPINION AND CONSUMER SURVEYS

Presiding—GEORGE H. GALLUP
American Institute of Public Opinion; Director, Copy Research Department, Young & Rubicam

ALBERT D. FREIBERG
Technical Director, Marketing Research, The Psychological Corporation

DANIEL KATZ
Associate Professor of Psychology, Princeton University

PAUL F. LAZARSFELD
Director, Office of Radio Research, Columbia University

HENRY C. LINK
Director, Marketing Research, The Psychological Corporation

MILLER MCCLINTOCK
Director, Research Division, Can Manufacturers Institute

FRANK STANTON
Director of Research, Columbia Broadcasting System

DANIEL STARCH
Consultant, Commercial Research, Daniel Starch and Staff

This panel revolved primarily around specific questions. The keynote of the questions and responses was:

TO WHAT EXTENT CAN PUBLIC OPINION AND CONSUMER SURVEYS HELP TO CHART THE FUTURE?

Each panel member responded to a question asked by Dr. Gallup, the leader of the discussion. Following this, other panel members and members of the audience joined in the discussion.

While elections test the accuracy of the results of public opinion surveys, can sufficiently convincing tests of the accuracy of the results of consumer surveys be developed so that business management can feel entirely justified in basing important polices on the findings?

Dr. Link pointed out that survey methods have developed to the point where they can be helpful to business management. The value of consumer surveys to business executives depends partly upon the attitudes of these executives and the way in which they utilize the results. On the basis of this, business men may be divided roughly into three groups.

First there is the business executive who has become very enamored of the development of polls of public opinion and consumer studies and has accepted them in a worshipful and uncritical attitude. This type of executive is harmful, not only to himself and his organization, but also to the future of consumer public opinion polling. His uncritical attitude leads him to make mistakes not only in acceptance but also in interpretation. In the second group one finds the extremely skeptical business man who doesn't believe in consumer research at all. He may have tried a consumer study, perhaps an inadequate piece of research. This type of business executive is becoming more and more scarce. Unfortunately, he is doing himself and his company more harm than the consumer research group. The third type might be labeled the skeptical believer. This man usually has some knowledge of research methods and techniques. He is willing to accept a study only if it meets certain scientific standards. He realizes that research itself will not settle all of his problems, but that scientific facts and evidence can serve as a basis for judgment. In this way surveys have been helpful to him.

How can repeated studies be used as a measure of the effectiveness of advertising or promotional activities?

Dr. McClintock. The outstanding development in the past decade in the field of marketing and advertising is the search for more scientific methods to determine the effectiveness of

advertising and selling. This development is illustrated by the increase in the number and size of organizations doing this type of work. This activity has been designed to increase efficiency and to give to the American people a greater economy.

In carrying out consumer studies, that is studies designed to look into the minds of people, we must first ascertain their needs, their susceptibilities, and the pattern of their present thinking. This investigation of needs and desires is in terms of the products we have to merchandise.

In engineering, for example, one of the fundamental principles is the prediction of the stresses and strains which materials and structures can withstand *in the future.* This prediction is based upon measurements of the stress and strain these materials can stand *at the present time.* Certain pressures and influences are brought to bear and then the changes or distortions which have taken place are measured.

It seems equally important that we measure the effect of influences which have been brought to bear on the mentality of the public. This of course seems particularly important at present when many of the marketing activities must necessarily be directed to what may be called "institutional needs," that is, the correction or changing of opinions and attitudes in which we are interested. In order to accomplish this, we must take measurements at many different times and at regular intervals, and correlate the changes which have taken place with the influences which have been brought to bear during these intervals. Only by such a procedure is it possible to know, not only what the status of any particular situation is at any one time, but more important, to determine the direction in which movements are going.

> To what extent has government or government agencies used public opinion or consumer survey results as a basis for decisions and rule-making?

Dr. Lazarsfeld pointed out that this was particularly significant now because the government was taking over more and

more of the economic life of the country. Therefore, if research is to do its share, government agencies and officials must be made aware of the possibilities of utilizing research. Research data and results must be given their true place in governmental functions. At the present time, for example, public opinion poll and consumer survey results are not permissible evidence in court. They are classified as hearsay evidence and as such are not admitted. This is only illustrative of the need for education.

There are, however, many governmental agencies and departments doing research, or using research of outside organizations. The important thing is to try in every possible way to see that this research is of the highest possible level, that it is unbiased, and that it utilizes fully the practical background of research men in business and industry at the present time. The indications are that there is at least the beginning of a definite trend for more and more research to be used by the government.

How can consumer surveys safeguard for the future a consumer who demands more than enough to maintain a mere biological existence?

Dr. Freiberg. Business and industry have realized that the needs and desires of the consumer must be satisfied. Survival of a particular business or industry has depended upon that industry being able to give the consumer what he wanted or needed.

For some time now the consumer has had a wide range of choice in purchasing almost any article. He could select X brand or Y brand or Z brand of a commodity as he chose. By so choosing the consumer was actually exercising a voting franchise, by "voting" for or selecting a particular brand or company. Any manufacturer who received a very small number of votes found himself out of office.

During the next few years, however, there will be extremely rigid restrictions of consumer goods not only in type and kind,

but also in quantity. The consumer will have many less "votes" to cast for products. Nevertheless, the manufacturer of consumer products should carry on consumer research so that the consumer can still exercise within limits his choice of what he wishes to have. Only by keeping alive in the knowledge of the consumer the fact that he does have something to say about what he gets will this democratic process be maintained. If the consumer does not continue to have at least some choice, he may get out of the habit of expecting this freedom of action. If this occurs, business as we know it will cease to exist, because business survives on a competitive basis, not on a monopoly basis. This is true whether the monopoly is privately fostered or whether it is owned by Government.

> Can future coalitions of interest groups be predicted from present common values and attitudes? Would one predict a coalition between farmers and business groups as against labor, on the basis of present opinion studies?

Dr. Katz. So far, in predicting future events and attitudes we have used almost entirely the results of time series or trends. Attitudes and opinions have been measured from time to time, and trends established. On the basis of these the future has been predicted. Dr. Gallup has repeated many of his questions from time to time to develop trend series for the entire nation.

Any prediction of future coalition of interest groups would necessitate not only the accurate prediction of trend lines, but also an interpretation of the extent to which interests and attitudes in common might serve to bring about the coalition of these groups. This type of research would necessitate very complete breakdowns, analyses in relation to specific groups, and a determination of the extent to which common interests, attitudes, and values would serve as a basis for unified action. Such studies would not only be extremely important for the legislator and social planner, but would be extremely helpful in building and maintaining morale during the difficult times which are ahead.

How can believability of advertising be measured through consumer research? To what extent would such findings help to chart the future course of advertising and selling methods?

Dr. Starch. This question is currently very important because of the increased interest in the problem of believability as well as the importance of various movements among consumers. They have been raising questions of believability of advertising and have been criticising selling and advertising from this point of view. Research methods have been developed to measure believability within reasonable limits. Naturally the accuracy with which the answer must be obtained varies from problem to problem. Therefore, the techniques or methodology are varied somewhat. However, reliable answers can be obtained. Facts serve as the basis for predicting future events and should be part of planning and management. However, facts themselves cannot take the place of judgment. They simply serve as tools which can be used to effect better and sounder judgment.

Believability in advertising and selling methods is becoming increasingly important. Believability has been under-rated in the field of selling by many people. Believable statements in advertising can be and are being made just as attractive and alluring as statements that verge on the untruthful. One of the excuses for using statements which verge on the borderline of untruthfulness is that they are more effective in reaching people and in alluring them. This is wrong. True statements and reliable representations can be made and are being made just as attractive and convincing. Furthermore, believable statements are more effective in influencing action. There is evidence which indicates quite definitely that truthful statements are not only as effective and as interesting as questionable statements but even more effective.

Interviewer Bias—Have any standardized tests been developed to check on the interviewer?

Dr. Stanton. This question poses a serious problem. It is important that we examine the tools which we use in obtaining data which later are used as the basis for judgment by men in business and industry. In many research studies it is necessary not only to have a sample of big cities or small cities, but of all parts of the country, and that means having a pretty good field investigating staff. Sometimes one sits in one's office and wonders what is actually happening in the field. Many a research man has wondered whether he had the courage to look inside of all the data to see where the bugs are. He's been just a little afraid to try to lift the bugs out. At least two aspects of the interviewer problem are important. First, the selection of the sample, and second, the whole matter of asking questions. A great deal of work has, of course, been done on this subject.

We tried a little experiment, exposing nonsense materials to a group of people. A test set of materials, consisting of ten of the nonsense materials previously exposed and ten others not in the original series, was made up. Then three groups of professional investigators were selected. Group A was correctly informed as to which materials had been exposed; Group B was incorrectly informed; and Group C was told nothing. Each group then interviewed people who had seen the originally exposed materials, asking the respondents to identify the items in the original series. None of the investigators tried, obviously at least, to influence the respondents' answers.

Nevertheless, those stimulus objects which the investigators thought had been seen by the people they were interviewing showed the highest scores. This suggests a whole field of problems which should be solved. Undoubtedly the individual investigators vary in the extent to which they unintentionally give cues to the people responding. If an interviewer test could be developed to measure this and used to select the most impartial investigators, a forward step would be taken. No research is better than its field work. If we are going ahead with public opinion and advertising studies, the problem of

investigator's bias should be studied and efforts made to clear it up.

Dr. Link responded by saying that he has always felt that interviewer bias was present to some extent at least in all research. One of the ways in which the Psychological Corporation has overcome this bias is to spread the risk of interviewing over many interviewers. That is, each interviewer is allowed to make only a small number of interviews. In this way the risk is distributed. The problem of properly selecting the sample is taken care of, at least to an appreciable extent, by the mapping out of areas in terms of economic groups in each city and town in which the interviewing is done. In this way an interviewer can be told to get interviews in certain areas.

Dr. Gallup remarked that there is another type of interviewer who causes difficulties, namely, the person who is a complete crook. This is the person who marks ballots or fills in interview forms in the corner drug store, or while having a coke or a glass of beer, etc.

Dr. Lazarsfeld indicated that one method which he had used in overcoming bias was to get the person interviewed to express his opinion in a variety of ways. Then it is possible to analyze the results in the office and determine from the broad attitudes of the respondent what he really means by the words he uses.

PANEL II—INDUSTRIAL PSYCHOLOGY AND PERSONNEL

Presiding—WALTER V. BINGHAM
Chief Psychologist, Personnel Procedures Section, The Adjutant General's Office

GEORGE K. BENNETT
Director, Test Division, The Psychological Corporation

HAROLD B. BERGEN
Partner, McKinsey and Company, New York City

A. B. GATES
Director of Training, Eastman Kodak Company

A. W. KORNHAUSER
Associate Professor of Psychology, University of Chicago

WILLIAM M. LEISERSON*
National Labor Relations Board

ALLAN H. MOGENSEN
Industrial Consultant

THOMAS M. STOKES
Field Training Division, Metropolitan Life Insurance Company

M. S. VITELES
Professor of Psychology, University of Pennsylvania

Dr. Bingham opened the panel meeting by presenting the topic for discussion:

HOW CAN INDUSTRIAL PSYCHOLOGY BEST CONTRIBUTE TO OUR NATIONAL ECONOMY? WHAT ARE THE PROBLEMS OF THE INDUSTRIAL PSYCHOLOGISTS DURING THE NEXT TWENTY YEARS?

He proceeded by introducing the members of the panel, asking each to submit proof of his right to the title, "industrial psychologist," and his right to be on this particular industrial panel.

Bingham: Have psychologists significantly contributed to better training, better morale, and better human efficiency?

Viteles: Yes. Extensive work has been going on in applying tests and techniques in hiring workers and promoting them. Psychologists have contributed certain techniques, and experimental methods.

Mogensen: Psychologists haven't contributed a great deal to human efficiency. The important contributions in that line have been made by the industrial engineers.

Viteles: In the European countries the psychologist has taken on as one of his functions the field of work that is under

* Dr. Leiserson was unable to attend, but sent his comments by letter.

the domination of the industrial engineer here. In this country improved efficiency has come from improved selection, improved training.

Kornhauser: Psychologists have contributed above and beyond industrial engineers. They have studied the relative value of wage incentive systems: (a) to determine whether wage incentive systems as a whole are as good as they ought to be, and (b) to determine the relative value of incentive and non-incentive systems.

Bingham: Have you run across situations in which the problem of incentive has been approached in the spirit of research?

After some discussion the comments might be summed up as follows: There have been definite contributions in the field. Psychologists have defined an area in the field of incentives—in the motives and the attitudes of the workers toward personnel managers. These are going to be important problems for industrial psychologists in the years to come. There is a necessity for the improvement in techniques, for ascertaining attitudes with greater accuracy.

Bingham: Have there been very substantial contributions made by the psychologists in techniques as well as in the accumulation of valuable information obtained by the use of these techniques in ascertaining what workers think, what is on their minds, what their preferences really are? What is required in the next twenty years in order to improve the techniques and extend the scope of the psychologists' usefulness?

Kornhauser: The psychologists have so far been using refined techniques. There is a need for much greater development of the informal interview technique. Ways of conducting penetrating interviews should be developed. Get at guiding hypotheses, (i.e., what labor unions really mean to the individual worker). This can be done better on the basis of broader community studies outside of the plant rather than within the plant, although these latter are of value.

Much can be done by the better training of skilled foremen and supervisors to detect labor troubles. Management's procedure is often to have specialized counselors who have no authority or responsibility to management in each department, whose sole function is to be "listening posts." Better results are obtained when trained supervisors do it themselves.

Mogensen: The use of specialized counselors is the quickest way to turn men into the unions. Foremen should be part of the management.

Leiserson: Problems of labor relations are primarily problems of psychology. (1). Is there such a thing as management and worker's attitude? If so, how can they be brought to function cooperatively to a common purpose. (2). The development and spread of labor organizations among employees has led to the desire for organization among foremen. Part of management feels that it has interests opposed to those of another part of the management. These interests are sometimes allied more with the groups below rather than those above them.

Viteles: There should be some kind of system whereby psychologists could be specifically trained for industry. Academic training plus actual practical experience in industry is needed.

Bergen: Unless foremen are made a part of management, good relations will never exist. Foremen must be included in the management group to have good employee relations below.

Gates: Psychologists should educate that part of society which is not conscious of its social obligations. Education of the people in the company to the point of view that each individual should make the contribution that he ought to in the job he finds himself in.

Bingham: There is a primary need for selecting and developing leaders. This program might be outlined as follows:

1. Select those men who have the qualities of leadership.
2. Train these men to lead. The need for training men to be leaders is most important.

3. Find ways of identifying those men who have ability to become leaders.
   a. These men should have the ability to teach and train men.
   b. They must be able to make the teams they are leading *want* to do what their mission is.
   c. They must make the men feel that they are to do their work not because they are told to do it but because they *want* to do it.

Real leadership is needed in the plant. The real leader is the man who can get his followers to do what is in the common interest and what is the common objective of the enterprise.

In the Army men are selected for officers who have imagination and foresight and who can anticipate all sorts of contingencies which are not obvious in the situation at first. This same type of man is needed for the leaders in a plant.

The job of the psychologist is to discover the people who have it in them to develop along these lines and to find out how to train them to be superb in the elements of leadership. Morale is a function of good or bad leadership. Therefore, the psychologists' problem is to find and develop people in industry who have that quality of leadership.

PANEL III—PSYCHOLOGY AND THE INDIVIDUAL

What are the Resources of Psychology in Maintaining the Morale and Effectiveness of the Individual?

Presiding—WALTER R. MILES
Professor of Psychology, School of Medicine, Yale University

ROSE G. ANDERSON
Associate Director, Psychological Service Center, New York City

JOSEPH V. HANNA
Assistant Professor of Psychology, New York University

MORRIS KRUGMAN
Psychologist, Bureau of Child Guidance, N.Y.C. Board of Education

CARNEY LANDIS
Principal Research Psychologist, New York Psychiatric Institute

ERNEST M. LIGON
Associate Professor of Psychology, Union College

C. M. LOUTTIT
Office of the Coordinator of Information, Washington, D. C.

WINIFRED V. RICHMOND
Psychologist, St. Elizabeth's Hospital

This panel concerned itself chiefly with needed improvements in handling problems of the individual, the use and place of testing, interviewing, projective, and other techniques, limitations and needed changes in the training of psychologists, prerequisites other than training and the relevancy of these to students in training.

Psychologists faced daily with the realistic problems of living are keenly aware of the need for extendng their scope and usefulness. There is room for encouragement in the actual progress made during the last two decades: the shift from preoccupation with the institutional concerns of identification and segregation of the mentally deficient to include the fullest development of the potentialities of all individuals; the transition from study of one isolated aspect of the individual to concern with the dynamic inter-relationships which comprise the totality of the individual; the advance from the exclusive dependence on testing (chiefly Binet) to the comprehensive clinical study including a variety of approaches.

Although the precedents for the best present practice were inherent in Witmer's earliest work, they were overlooked through the unfortunate identification of clinical psychology with mental testing which became (and in some quarters still is) an end in itself.

Clinical psychologists are thought by some to be too expressive about the limitations of their findings with resulting confusion rather than confidence of the layman. By others they are thought to be too concerned about the validity of any one test instead of recognizing the contribution which each makes to the total picture. They are more preoccupied with the

analysis of the individual than with the final synthesis and its implications.

The ability to "go beyond" the objective test results and their statistical significance is the distinguishing criterion between the tester and the clinician. This ability involves both aptitude and specific emphases in training and in the supervised experience. The former is essential for an adequate response to the latter. Students can be differentiated on this basis in their first clinical courses and should be advised accordingly. This is a responsibility training institutions must recognize and accept if professional psychology is to advance. They need also to recognize that potential consultants need at least as high a level of scholastic aptitude as do future teachers and research workers, and in addition specific personality qualifications and interests.

Differences of opinion were expressed as to the contribution of projective techniques (specifically the Rorschach Test), *viz.*, they provide more valid personality data; they do not reveal more than can be learned through other approaches; responses are susceptible to suggestion; they take a disproportionate amount of time for their contribution.

The contributions to civilian morale discussed included vocational guidance, counselling as to the importance for defense of maintaining civilian life and emotional balance, promoting participation in group welfare and defense projects, emphasis on readjusting values from material selfish interests to inclusion of the welfare of the group. Much of the latter can be accomplished through mental hygiene courses and discussion groups. Psychologists should develop a "psychological first-aid" course which could be offered by adult education centers along with other defense courses.

Such contributions imply a comprehensive orientation in the related fields of anthropology, social case work, and psychiatry.

In his summing up, Dr. Miles made a plea for more active interchange among psychologists of helpful procedures prior to the publication stage.

MOTOR AND MECHANICAL ABILITIES IN PROFESSIONAL SCHOOLS[1]

CLAUDE EDWARD THOMPSON
Northwestern University

THE purpose of this investigation is two-fold: (1) to contribute further evidence concerning the organization of motor and mechanical abilities into specific, group, or general factors, and (2) to determine whether or not any of these factors are measurably related to success in different professional schools of a university.

The present study centered in the College of Dentistry at the Ohio State University, where motor and mechanical abilities are important in the curriculum. Since 1932, a Committee on aptitude testing has reported annually to the American Association of Dental Schools, and Moss (9, 10), in a series of reports presented before the Association, has followed the progress of the use of measures of aptitude in selecting and counseling students. He indicates that at present about half the dental schools in North America are using such measures. The present study is interested primarily in those tests which measure motor and mechanical abilities. Results of studies using other tests in dentistry are summarized elsewhere (1).

At the University of Iowa, work on the Iowa Dental Qualifying Examination has been carried on for a number of years. Several revisions have resulted from experimental tryout (1, 7, 12, 13). Five of the tests in this battery are concerned with theoretical applications of information pertaining to dentistry. The tests dealing with technical phases of ability are a spatial relations test which sets the problem of fitting small figures into larger figures of differing shapes, and a work-sample test

[1] This work was part of a thesis presented to the graduate school of the Ohio State University for the degree of Doctor of Philosophy.

of measuring and trimming a plaster-of-Paris block to specifications. The results from correlating the spatial relations test with first-year technical grades for 424 subjects in ten schools provide an average correlation of .41. Correlating the trimming test with first-year technical grades of 337 Iowa dental students over a period of seven years gave an average correlation of .62. For 74 Iowa students, the spatial relations test correlated .52 with first-year technical grades, and a multiple correlation of .73 was obtained by combining it with the trimming test.

The Minnesota studies of factors in dental success (1, 5, 6) indicate that the Metal-Filing Work-Sample (setting somewhat the same problem as the Trimming test), the O'Connor Tweezer and Finger Dexterity tests, and the Iowa Spatial Relations test correlate fairly well even with the undifferentiated criterion of average point-hour ratio in all courses. One sample of 83 students provided correlations of .53, .30, .39, and .52 respectively for these tests. A multiple correlation of .71 was obtained by combining predental grades with Metal-Filing test scores.

Schultz (11) tested 90 second-year dental students at the University of Pennsylvania on the American Council on Education Psychological Examination and the Miles Two-Story Maze and correlated the scores with grades in technical courses for the second year. The two-story maze correlated .32 and the Psychological Examination .23 with the criterion. Harris (8) tested 68 dental students on five mechanical aptitude tests (Tweezer and Finger Dexterity, Wiggly Block, Hand Steadiness, and Cube Carving), the Otis Intelligence test, and two measures of predental school work and correlated the results with scholarship in the first and the four years of dental school work. The mechanical aptitude tests (including the Cube Carving test with which Bronner (4) obtained a correlation of .49 with grades in prosthesis) gave negligible correlations with dental school scholarship. The Otis test and predental scholarship both showed a substantial relationship to the cri-

terion and when combined gave a multiple correlation of .67 with dental school marks.

Bellows (1) has recently made a review of the few studies dealing with the predictive value of tests for selecting dental students and describes a tentative battery of 34 predictor items selected for tryout at the Baltimore College of Dental Surgery, University of Maryland. The tests consist of twenty-two sub-tests of primary mental abilities (Thurstone); seven paper-and-pencil sub-tests for mechanical ability (MacQuarrie); tests of achievement in chemistry and zoology (Cooperative Test Service, American Council on Education); measurement of interest in the profession of Dentistry (Strong); and an individual test of finger agility (Worker Analysis Section). Bellows recognizes the necessity for validating manipulative tests against manipulative criteria and non-manipulative tests against non-manipulative criteria.

TESTS AND PROCEDURES USED IN THIS STUDY

Over 100 practicing dentists in the state of Ohio were questioned by letter and interview concerning the essential abilities required in a good operator. In addition the faculty of the College of Dentistry at Ohio State University were interviewed. Considerable time was also spent studying the seniors at work in the clinic at the school. The results indicate close agreement with those cited by Bingham (2). On the basis of this information, the following eight tests were selected and constructed: revisions of the O'Connor Tweezer and Finger Dexterity tests (2); five paper-and-pencil spatial relations tests used by Brigham (3) called Form Learning, Block Counting, Cube Matching, Cube Construction, and Mirror Image; the Minnesota Paper Form Board, Likert and Quasha revision Form AA (which has already been well standardized); the Mirror Tracing test and the Fine Instrument test (14).

The five-test paper-and-pencil battery of spatial relations tests was administered to 448 students in the general psychol-

ogy area at the Ohio State University in order to obtain norms on an unselected sample of the general college population. The reliabilities of the five tests were obtained by test-retest, using 75 students and a three-weeks interval (Table 1). The

TABLE 1

Reliabilities of Tests Used and Means and Standard Deviations for All Groups on All Tests

Test	Reliability of tests		General college group		Freshmen in dentistry		Seniors in dentistry		Fine arts group		Test retest group	
	r / SDr	N	M / SDM	N	M / SDM	N	M / SDM	N	M / SDM	N	M / SDM	N
Form Learning	.77 / .05	74	10.8 / 4.3	448	12.8 / 5.0	35	11.6 / 3.9	40	14.2 / 3.8	50	12.7 / 4.4	74
Block Counting	.82 / .04	73	21.1 / 9.6	448	27.7 / 10.2	35	34.6 / 6.4	40	24.9 / 11.1	50	28.3 / 12.4	73
Cube Matching	.68 / .06	71	3.3 / 2.3	448	4.1 / 2.2	35	7.6 / 1.7	40	4.7 / 2.5	50	4.2 / 2.5	71
Cube Construction	.77 / .05	72	7.2 / 3.6	448	5.8 / 2.8	35	9.1 / 2.0	40	7.7 / 4.3	50	8.5 / 5.1	72
Mirror Image	.75 / .05	73	8.1 / 3.1	448	8.9 / 3.8	35	8.7 / 3.1	40	9.9 / 3.5	50	9.9 / 2.7	73
Paper Form Board					39.3 / 8.8	35	42.4 / 13.9	40	40.8 / 10.2	50		
Fine Instrument	.92 / .01	146	507 / 113	146	469 / 97.4	35	447 / 68	40	535 / 65.5	50	507 / 113	146
Mirror Tracing	.67 / .04	161	51 / 17	161	26.5 / 9.1	35	31 / 13	40	62.1 / 25.7	50	51 / 17	161
Tweezer Dexterity	.86 / .02	161	548 / 108	161	417 / 79.6	35	388 / 52	40	413 / 52.7	50	548 / 108	161
Finger Dexterity	.67 / .04	161	660 / 94	161	620 / 97.4	35	612 / 72	40	624 / 94	50	660 / 94	161
Point Hour Ratio					2.35 / .75	35	2.33 / .40	40	2.90 / .53	50		

Tweezer and Finger Dexterity tests and the Mirror Tracing tests were administered to 161 students and the Fine Instrument test to 146 students under the same conditions as for the paper-and-pencil battery (Table 1). Though some of the coefficients are lower than is desirable for individual prediction, they are considered high enough for group comparisons.

The ten tests were then administered to 35 freshmen and 40 seniors in dentistry. As a control group, 50 unselected students in the department of Fine Arts were used and their scores on the tests compared to those of the general college group and the freshmen and seniors in dentistry. The reliabilities of the tests and the means and standard deviations for all groups on all tests are summarized in Table 1.

CRITERIA

The criteria used in this study were:

(1) Average point-hour ratio for the first year in dentistry for freshmen; average point-hour ratio for the four years for seniors; average point-hour ratio for Fine Arts students. Analysis revealed no statistically reliable differences between grades in technical and theoretical courses in dentistry. This was partly because laboratory grades were combined with lecture grades in assigning the final grade, the only one entering the records.

(2) Combined paired-comparison ratings for the freshmen, assigned by the two instructors in laboratory work on the basis of two pieces of completed work at the end of the freshman year; combined paired-comparison ratings for the seniors assigned by the two technic instructors on the question, "Which one of these men in mechanical ability alone is better?" The work of the seniors largely has to be observed as it occurs, since the work leaves the clinic with the patient. State Board results on the seniors were unavailable in suitable form for this study. The results are reported according to minimum standards, numerical scores are not reported, and order of merit ratings are not obtained.

TABLE 2

Intercorrelations of Ten Tests and Correlations with Criteria for 35 Freshmen in Dentistry

		2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Form Learning	r	.23	.12	.27	.03	.25	.36	.13	.14	.34	−.01	−.01	−.03	−.05	−.03
	SDr	.16	.16	.16	.17	.16	.15	.16	.16	.15	.17	.17	.17	.17	.17
2. Block Counting			.21	.56	.36	.30	−.02	.23	−.32	−.21	.00	.23	.37	.33	.26
			.16	.12	.15	.15	.17	.16	.15	.16	.17	.16	.15	.15	.16
3. Cube Matching				.10	.25	.24	.00	.28	.09	−.11	−.21	−.04	.29	.17	.00
				.17	.16	.16	.17	.16	.17	.17	.16	.17	.16	.16	.17
4. Cube Construction					.22	.50	−.02	.32	−.35	−.11	−.11	.11	.08	.14	.18
					.16	.13	.17	.15	.15	.17	.17	.17	.17	.17	.16
5. Mirror Image						.14	.04	.33	−.25	.07	−.13	.25	.42	.39	.32
						.16	.17	.15	.16	.17	.16	.16	.14	.14	.15
6. Paper Form Board							−.04	−.32	−.15	−.08	.04	.16	.15	.16	.24
							.17	.15	.16	.17	.17	.16	.16	.16	.16
7. Fine Instrument								.22	.46	.37	−.24	.06	.10	−.06	−.05
								.16	.15	.13	.16	.17	.17	.17	.17
8. Mirror Tracing									−.04	−.05	−.05	−.17	.27	−.07	−.10
									.17	.17	.17	.16	.16	.17	.17
9. Tweezer Dexterity										.47	−.26	.07	.06	.09	−.07
										.13	.16	.17	.17	.17	.17
10. Finger Dexterity											.09	.06	.16	.10	.01
											.17	.17	.16	.17	.17
11. Point Hour Ratio												.20	.10	.13	
												.16	.17	.16	
12. Marshall Ratings													.68	.98	
													.09	.03	
13. Schumway Ratings														.90	
														.03	
14. Combined Ratings															
15. Grades & Combined Ratings															

(3) A combination of point-hour ratio and combined ratings of instructors.

RESULTS

Intercorrelations among tests for freshmen (Table 2) are low, some of the coefficients are negative, and the range is from $-.38$ to $+.56$ with the average at $.12 \pm .16$. With point-hour ratio no test correlates three times the standard error. With combined ratings of instructors only Block Counting ($.33 \pm .15$) and Mirror Image ($.39 \pm .14$) correlate at least twice the standard error. With the combination of grades and combined instructors' ratings (Table 2) Block Counting correlates .26, Cube Construction .18, Mirror Image .32, and Paper Form Board .24. None of these correlations is more than twice the standard error, and other tests correlate still lower with this criterion. With a combination of grades and instructors' ratings no correlation is significant.

Intercorrelations of the tests for seniors (Table 3) range from $-.21$ to $+.49$ with the majority trending not far from zero and the average at $.09 \pm .16$. The higher correlations, as in the case of freshmen results, are for those tests which seem to call for similar activities, *e.g.*, Tweezer and Fine Instrument tests. No correlation is significant in relation to the standard error. With combined instructors' ratings, Minnesota Paper Form Board correlates $.65 \pm .09$. The Tweezer Dexterity test is the only other test correlating at least twice the standard error with this criterion ($.38 \pm .14$). With point-hour ratio the Paper Form Board correlates $.32 \pm .14$ and the Cube Matching test $.38 \pm .14$. Other correlations are still less significant. With a combination of grades and combined instructors' ratings, the Paper Form Board correlates $.61 \pm .10$. The correlations of other tests possess no significance.

Intercorrelations of tests for Fine Arts students (Table 4) range from $-.17$ to $+.69$ with the average at $.22 \pm .13$. No correlation with grades approaches three times the standard error.

TABLE 3

Intercorrelations of Ten Tests and Correlations with Criteria for 40 Seniors in Dentistry

		2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Form Learning	r	.27	.06	.26	.18	.14	−.14	.15	.15	−.06	.12	.00	.16	.11	.11
	SDr	.15	.16	.15	.15	.16	.16	.15	.15	.16	.16	.16	.15	.16	.16
2. Block Counting			.15	.02	.49	−.12	.10	.46	−.01	.14	.08	−.05	.07	.07	−.01
			.15	.16	.12	.16	.16	.16	.16	.16	.16	.16	.16	.16	.16
3. Cube Matching				.15	.28	.18	.16	.21	.05	.06	.38	.07	.26	.18	.22
				.15	.15	.15	.15	.15	.16	.16	.14	.16	.15	.15	.15
4. Cube Construction					.36	.01	−.06	.03	−.21	−.14	−.07	−.09	.09	.01	.04
					.14	.16	.16	.16	.15	.16	.16	.16	.16	.16	.16
5. Mirror Image						.06	−.05	−.27	−.15	−.05	−.08	−.07	.16	.10	−.02
						.16	.16	.15	.15	.16	.16	.16	.15	.16	.16
6. Paper Form Board							.19	−.11	.32	.11	.31	.61	.68	.65	.61
							.15	.16	.14	.16	.14	.10	.09	.09	.10
7. Fine Instrument								.09	.39	.34	.05	.22	.01	.12	.05
								.16	.13	.14	.16	.15	.16	.16	.16
8. Mirror Tracing									−.02	.05	−.01	.05	.13	.12	−.10
									.16	.16	.16	.16	.16	.16	.16
9. Tweezer Dexterity										.30	.15	.34	.49	.38	.13
										.14	.15	.14	.12	.14	.16
10. Finger Dexterity											.00	.12	−.12	.01	.01
											.16	.16	.16	.16	.16
11. Point Hour Ratio												.45	.45	.47	
												.13	.13	.12	
12. McFarland Ratings													.74	.94	
													.07	.02	
13. Strosnider Ratings														.90	
														.03	
14. Combined Ratings															
15. Grades & Combined Ratings															

TABLE 4

Intercorrelations of Ten Tests and Correlations with Criteria for 50 Fine Arts Students

		2	3	4	5	6	7	8	9	10	11
1. Form	r	.24	.15	.07	.27	.06	.10	−.17	.19	.18	−.19
Learning	SDr	.13	.14	.14	.13	.14	.14	.14	.14	.14	.14
2. Block			.33	.55	.69	.01	.42	.10	.26	.38	.23
Counting			.13	.10	.07	.14	.11	.14	.13	.12	.13
3. Cube				.43	.45	.27	−.12	.04	−.13	.10	−.08
Matching				.11	.11	.13	.14	.14	.14	.14	.14
4. Cube					.70	.37	.29	.10	.38	.23	.21
Construction					.07	.13	.13	.14	.12	.13	.13
5. Mirror Image						.21	.30	−.03	.26	.33	.09
						.14	.13	.14	.13	.13	.14
6. Paper Form							.18	.10	.15	.19	.18
Board							.14	.14	.14	.14	.14
7. Fine								.20	.41	.37	.17
Instrument								.14	.12	.13	.14
8. Mirror									.19	.07	.01
Tracing									.14	.14	.14
9. Tweezer										.44	.08
Dexterity										.11	.14
10. Finger											.21
Dexterity											.12
11. Point Hour Ratio											

Analysis of critical ratios (Table 5) reveals the following:

(1) Freshmen in dentistry are significantly superior as a group to the General College Group on Block Counting, Tweezer Dexterity, and Mirror Tracing; are superior to Fine Arts Group on Fine Instrument and Mirror Tracing.

(2) Seniors in dentistry are significantly superior to the General College Group on Block Counting, Cube Matching, Mirror Tracing, Cube Construction, Tweezer Dexterity, Finger Dexterity, and Fine Instrument; are superior to Freshmen in

TABLE 5

Critical Ratios Between the Means of the Scores for the General College Group, Dentistry Freshmen, Dentistry Seniors and the Fine Arts Group on Ten Tests

	Cube Matching				Cube Construction				Form Learning			
Group	I	II	III	IV	I	II	III	IV	I	II	III	IV
I		2.74	5.28	.84		2.31	5.68	.11		2.24	1.23	5.77
II			7.53	1.19			5.79	2.49			2.34	2.40
III				6.49				2.03				3.07

	Block Counting				Mirror Image				Fine Instrument			
	I	II	III	IV	I	II	III	IV	I	II	III	IV
I		3.71	12.3	2.33		1.23	1.24	3.44		2.01	4.20	2.10
II			3.49	1.20			.20	1.23			1.12	3.51
III				5.24				1.66				6.20

	Tweezer Dexterity				Finger Dexterity				Mirror Tracing			
	I	II	III	IV	I	II	III	IV	I	II	III	IV
I		8.24	13.6	12.0		2.22	3.53	2.37		12.2	8.33	2.92
II			1.85	.25			.40	.19			1.73	9.13
III				2.27				.68				7.56

	Paper Form Board	
	III	IV
II	1.19	.73
III		.62

Legend: Group I: General college group.
II: Dentistry freshmen.
III: Dentistry seniors.
IV: Fine Arts group.

Block Counting, Cube Matching, and Cube Construction; are superior to Fine Arts Group on Fine Instrument, Mirror Tracing, Block Counting, and Cube Matching.

(3) The Fine Arts Group is significantly superior to the General College Group on Form Learning, Mirror Image, Tweezer Dexterity, and Mirror Tracing (though here the critical ratio is 2.92). On Form Learning, the Fine Arts Group is significantly superior to the General College Group, the Seniors in dentistry, and is superior to the Freshmen in

dentistry, though in the last case the critical ratio is 2.40, whereas 3.00 was the standard for significance set up.

The similarities revealed between the Fine Arts Group and the College of Dentistry groups and the significant differences in turn between these groups and the General College Group in certain of the tests measuring spatial relations abilities probably is a measure of the extent to which the training in the two schools is similar in behavior which might be labeled as artistic abilities. The similarities in performances on mechanical abilities tests between the Fine Arts and Dentistry groups and their superiority to the General College Group are probably indicative of the extent to which Fine Arts training and dental training involve development of the same mechanical abilities. The degree to which they differ in these aspects, *e.g.*, Form Learning, is indicative of the degree to which different skills, both mechanical and artistic, are required in differing degrees in the two courses of training. It is possible that had other tests measuring still different functions been added to those used, other distinctions could have been made.

One of the prime requisites in the testing of aptitudes is that the field of achievement be adequately defined by the experts in the field. This is a different thing from the ability on the part of those same experts to recognize the behavior belonging to a particular field when it is met in a complex situation, extract it, judge it independently from other factors, and render correct decisions concerning the degree of possession of behavior traits among the individuals of a group. In this sense the expert judgment may be accurate in one case and of varying degrees of inaccuracy in the other.

It is suggested that the criteria against which non-language abilities in dentistry are measured are inadequate because they are not measures strictly of the functions coming under the heading of mechanical abilities. If grades are to be used to validate tests of mechanical ability, they will have to be grades based only on mechanical ability, probably mechanical ability as demonstrated by product rather than by process.

If ratings of instructors are to be used as a criterion to validate tests of mechanical ability, these ratings are probably less valid when based on process than when based on product. This can be true even though instructors' ratings agree among themselves. Instructors may rate students independently, but it is fairly certain that the experiences which led to the ratings and the judgments themselves were not arrived at independently.

CONCLUSIONS

The results obtained in this investigation with the tests used indicate:

(1) The low average intercorrelations of the performances on the tests used in relation to the standard errors indicates the absence of a factor common to all the tests. The results appear to support the hypothesis of semi-specificity of ability in motor and mechanical skills. The trend toward increases in the size of correlations as tests of increasing perceptual and conceptual complexity are compared, and the similarities found between students in dentistry and Fine Arts lead to the supposition that such "group factors" as may exist are generated by similarities in behavior generated by similarities in curricula.

(2) Usual criteria of success in professional subjects, namely grades or instructors' ratings, are inadequate to show the possible significance of motor and mechanical factors because: (a) Grades are known to be largely determined by intellectual and personality factors and (b) These intellectual and personality factors are not related to motor and mechanical skills. For a thorough test of the importance of motor and mechanical abilities it would therefore be necessary to set up criteria of success in manipulative skills alone within each field.

(3) Although experts in the field are agreed in *naming* the principal manipulative skills which are essential to success in operative dentistry, we have not yet been able to evolve *operational definitions* of these factors so that we can accurately

identify and measure their importance in technical processes or products.

(4) Students entering professional schools appear to be selected in that they differ significantly, as groups, from the general college population. Furthermore, as shown by the differences between freshmen and seniors in dentistry, these differences are accentuated either by selective dropping out of poorer students or training in the specialized curricula of the professional schools.

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READER PREFERENCES AND TYPOGRAPHY*

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AT the time we summarized our studies of typography, we restricted the presentation to speed of reading measures and reader preferences in regard to apparent legibility.[1] Knowing that this "efficiency" approach would be challenged by those inclined to stress aesthetic values in printing, we undertook a comprehensive study of reader preferences as to pleasingness of various typographical arrangements. We are now in a position to determine the extent to which judged legibility and judged pleasingness agree or disagree with each other.

In obtaining reader preferences with respect to apparent legibility, printed samples were presented to college students who were instructed "to arrange them in order from most legible to least legible." Legibility was defined as "ease and speed of reading." In a similar manner, pleasingness judgments were obtained from a different group of college students who were instructed to rank the same samples in order from most pleasing to least pleasing. No attempt was made to define "pleasingness."

Space limitations preclude the presentation of detailed results for all of the typographical arrangements studied. Table 1, giving the results for ordinary printing versus bold face, and for lower case versus all capitals is typical of the results obtained in all of the other comparisons.

Examination of the results in the upper portion of Table 1 shows that readers believe that lower case is far more legible

* The writers are grateful to the University of Minnesota Graduate School for research grant to finance this study.

[1] D. G. Paterson and M. A. Tinker, *How to Make Type Readable*, New York: Harper and Brothers, 1940, pp. 209.

TABLE 1

Legibility and Pleasingness Ratings of Two Contrasting Typographical Arrangements

NOTE: Each printing sample consisted of five paragraphs from the Chapman-Cook Speed of Reading Test printed in 10 point Scotch Roman, 19 pica line width, set solid on eggshell paper stock and in the typographical arrangements indicated below.

Typographical arrangement	Speed of reading		Judged legibility			Judged pleasingness		
	N	Mean score	N	Mean rank	σ	N	Mean rank	σ
Ordinary Lower Case versus Bold Face								
Lower case	100	18.38	224	1.3	.46	106	1.1	.33
Bold face		18.38		1.7	.46		1.9	.33
Lower Case versus All Capitals								
Lower case	320	18.83	224	1.1	.30	99	1.1	.26
All capitals		16.61		1.9	.31		1.9	.26

and at the same time is more pleasing than bold face, although both kinds of printing are actually read at the same rate. The important fact to note here is the close agreement between the ranks for judged legibility and pleasingness.

The results in the lower portion of Table 1 show that lower case is read much more rapidly (11.8 per cent) than all capitals and readers rank lower case ahead of all capitals both with respect to legibility and pleasingness.

The ordinary lower case versus bold face arrangement and the lower case versus all capitals arrangement were selected to illustrate two situations; one in which judgments were not in agreement with the speed of reading measures and the other where they are in agreement. Failure of judgments to agree with speed of reading measures has already been discussed at length in *How to Make Type Readable*. Our main interest at this time is directed toward the striking agreement between judged legibility and pleasingness.

The other typographical arrangements studied were: styles of type face, combinations of colored print and colored paper stock, leading, size of type, line width, paper surface, lower case versus italics, simultaneous variation of line width and type size, space and lines between columns, regularity of alignment versus indentation of alternate lines at left and right ends and simultaneous variation of type size and leading. In all cases judged legibility and pleasingness showed remarkable agreement. Here and there only a slight disagreement exists. In general, the agreement is so close that we are warranted in concluding that judged legibility may be accepted as equivalent to pleasingness. The judged legibility rankings have already been reported in *How to Make Type Readable.*

The question arises as to the meaning of such a close relationship between judgments of legibility and of pleasingness. Do readers put a high aesthetic value on arrangements believed to facilitate "ease and speed of reading"? Or do readers judge an arrangement to be legible because it is pleasing to the eye? Our data fail to disclose the causal relationship involved.

The results presented above provide a definite answer to those inclined to believe that aesthetic values should have greater weight than "efficiency" in determining printing specifications. The printer should be guided by the facts regarding the speed with which particular typographical arrangements can be read, and also by reader judgments of legibility. When a printing arrangement is shown to promote rapid reading and readers judge this arrangement to be legible, the printer, presumably would employ it. When two or more printing arrangements are equally legible, the printer presumably would employ the one judged to be most legible. However, when the most efficient printing arrangement is judged to be less legible than another, then the printer will be forced to decide whether or not he will cater to the opinions of the readers. In any event the printer's problem is simplified by the fact that readers place high aesthetic values on those printing arrangements which appear to be the most legible.

LEARNING THE TWO-HAND COORDINATION TEST

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THE lathe type test for measuring aptitude for two-hand coordination has been used by certain industrial organizations as an employee selection device. The origin of the test is not very well known. Apparently it stems from earlier forms originating in Europe. Bingham and Freyd (1, p. 107) report that it is known in England as the Compound Slide Rest Test. They describe one form of the apparatus which they call the Two-Hand Test. Hull classifies it as a miniature test, and describes a modification developed at Wisconsin (3, p. 67–69).

The data presented here were taken from a larger investigation of variability of performance, and suggest the general course of the learning curves obtained through regularly repeated trials. Moreover, they indicate some of the test's limitations as a selection device and, at the same time, suggest extension of the number of trials made in order to improve its reliability as a predictor.

When manipulating the apparatus, the subject rotates a pair of counter-balanced hand screws, one with each hand, simultaneously or separately, to move a disc .50 inches in diameter. The small disc must be made to follow a target disc describing an eccentric pattern within a circle 7.25 inches in diameter. Two target discs were used, .875 inches and .75 inches in diameter. At the end of 50 trials, the smaller target was substituted for the larger one. The target completed its course in one minute. The two discs, when in contact, closed an electrical circuit activating a clock calibrated in one-hundredths

of a minute. Thus the percentage of time on the target can be read directly from the face of the clock.

From a group of 28 men, 10 subjects were selected by choosing the five who scored highest and the five who scored lowest on a preliminary series of trials. The mean of the scores for six trials was used in making the selection. The method of selecting subjects, and the procedure followed, was determined by the conditions of the primary experiment from which these data were taken.

Each subject was given 5 trials morning and evening (10 trials daily) for a period of 10 days, *i.e.*, a total of 100 trials per man. Each of the 20 sessions required 5 minutes of testing time. Table 1 shows the age, years attended school, and the mental ability scores for each of the 10 subjects.

TABLE 1

Age, School and Mental Ability of Subjects

Subjects	Age	Years of school	Mental ability score*
	Highest 5		
A	25	14	38
B	28	13	33
C	27	12	25
D	32	12	18
E	19	8	15
Mean	26.2	11.8	25.8
	Lowest 5		
V	22	10	10
W	27	16	25
X	25	10	13
Y	22	11	23
Z	20	11	22
Mean	23.2	11.6	18.6
Total mean	24.7	11.7	22.2

* Wonderlic and Hovland revision of the Otis.

RESULTS

Learning to follow the test pattern was relatively rapid for

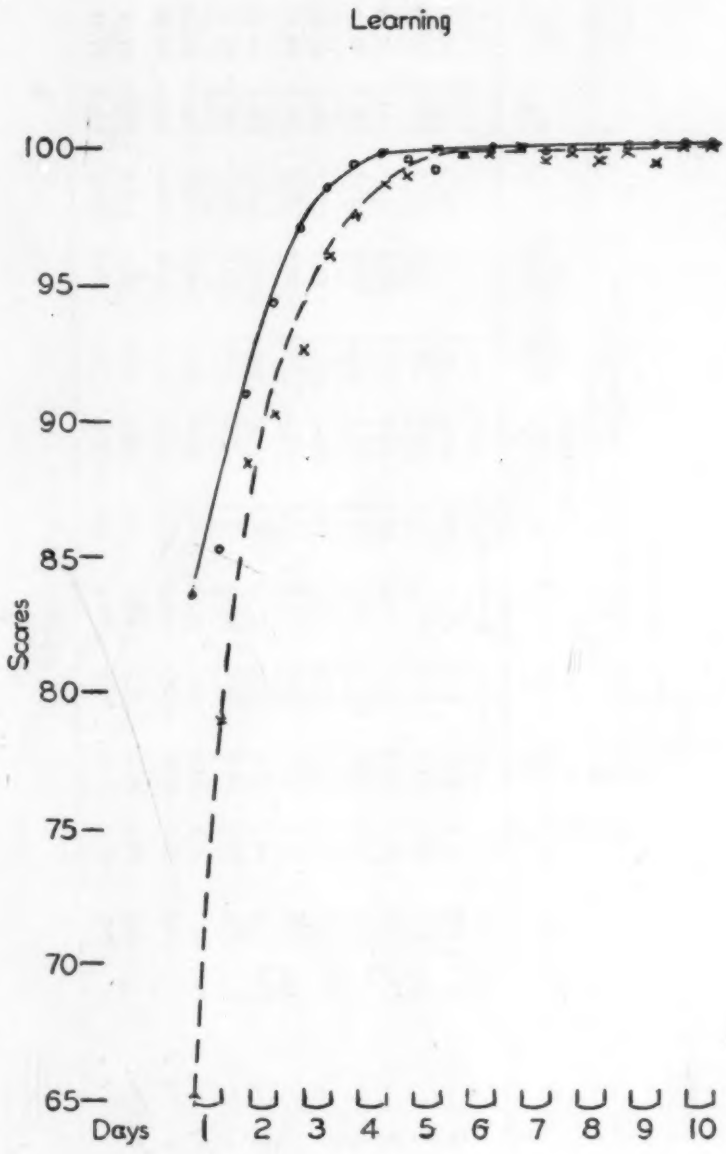
Learning
100
95
90
85
80
75
70
65
Scores
Days
1 2 3 4 5 6 7 8 9 10

TABLE 2

Individual Performance Scores Two-hand Coordination Test

Men	*I score		Days										Mn
			1	2	3	4	5	6	7	8	9	10	
			Highest 5										
A	81.5	AM	85.8	90.0	99.0	100.0	99.4	100.0	99.8	100.0	100.0	100.0	97.40
		PM	88.8	95.8	99.8	100.0	100.0	100.0	99.8	99.8	100.0	100.0	98.40
B	78.5	AM	84.6	92.6	97.8	98.6	98.8	99.6	100.0	100.0	100.0	100.0	97.20
		PM	85.6	98.0	100.0	99.2	99.2	100.0	100.0	100.0	100.0	100.0	98.20
C	77.1	AM	75.8	91.2	97.6	99.8	99.4	100.0	100.0	99.3	100.0	100.0	96.36
		PM	80.6	92.0	95.8	100.0	97.0	100.0	99.4	100.0	100.0	100.0	96.48
D	77.5	AM	84.0	87.4	92.4	99.2	100.0	100.0	100.0	100.0	100.0	100.0	96.30
		PM	80.0	88.6	97.6	100.0	99.2	100.0	100.0	100.0	100.0	100.0	96.54
E	75.3	AM	88.8	93.8	98.4	100.0	100.0	99.6	100.0	100.0	100.0	100.0	98.06
		PM	95.6	97.8	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	99.34
Mn		AM	83.8	91.0	97.0	99.5	99.5	99.8	100.0	99.9	100.0	100.0	97.06
		PM	86.1	94.4	98.6	99.8	99.1	100.0	99.8	99.9	100.0	100.0	97.78

TABLE 2—(*Continued*)

Men	*I score		Days										Mn
			1	2	3	4	5	6	7	8	9	10	
						Lowest 5							
V	42.1	AM	60.6	87.8	94.0	97.4	98.4	100.0	100.0	100.0	100.0	100.0	93.82
		PM	71.4	91.4	99.2	100.0	100.0	98.8	99.0	100.0	100.0	100.0	95.98
W	50.0	AM	60.2	86.0	87.6	96.4	98.6	99.6	100.0	99.4	100.0	100.0	92.78
		PM	77.2	87.4	93.8	96.8	100.0	99.8	100.0	97.6	100.0	100.0	95.26
X	50.5	AM	72.2	84.6	89.4	94.4	97.8	100.0	100.0	99.8	92.2	100.0	93.04
		PM	77.6	.87.4	90.0	97.2	100.0	99.8	100.0	100.0	100.0	100.0	95.20
Y	51.3	AM	63.2	87.0	94.4	99.4	100.0	100.0	100.0	100.0	100.0	100.0	94.40
		PM	83.8	90.4	97.8	100.0	100.0	100.0	100.0	100.0	96.6	100.0	96.86
Z	52.3	AM	70.4	92.8	97.8	100.0	100.0	100.0	100.0	100.0	100.0	100.0	96.10
		PM	85.2	94.6	99.4	100.0	100.0	100.0	99.0	100.0	99.0	100.0	97.72
Mn		AM	65.3	87.6	92.6	97.5	99.0	99.9	100.0	99.8	99.8	100.0	94.16
		PM	79.0	90.2	96.0	98.8	100.0	99.9	99.6	99.5	99.1	100.0	96.21
Mn-Mns		AM	74.56	89.32	94.84	98.52	99.24	99.88	99.98	99.90	99.92	100.0	95.62
		PM	82.58	92.34	97.34	99.32	99.54	99.94	99.72	99.74	99.56	100.0	97.01

* I score = Mean score of 6 preliminary trials.

TABLE 3

Individual Ranges of Performance Two-hand Coordination Test

Men		Days										Mn
		1	2	3	4	5	6	7	8	9	10	
						Highest 5						
A	AM	21	13	3	0	3	0	1	0	0	0	4.1
	PM	4	5	2	0	0	0	1	1	0	0	1.3
B	AM	8	12	4	7	3	2	0	0	0	0	3.6
	PM	20	9	0	2	3	0	0	0	0	0	3.4
C	AM	26	15	6	1	3	0	0	1	0	0	5.2
	PM	22	11	7	0	6	0	3	0	0	0	4.9
D	AM	11	12	7	2	0	0	0	0	0	0	3.2
	PM	21	10	6	0	4	0	0	0	0	0	4.1
E	AM	8	8	6	0	0	2	0	0	0	0	2.4
	PM	7	11	0	0	0	0	0	0	0	0	1.8
Mn	AM	14.80	12.00	5.20	2.00	1.80	0.80	0.20	0.20	0.00	0.00	3.70
	PM	14.80	9.20	3.00	0.40	2.60	0.00	0.80	0.20	0.00	0.00	3.10

TABLE 3—(*Continued*)

Men		Days										Mr.
		1	2	3	4	5	6	7	8	9	10	
						Lowest 5						
V	AM	40	18	8	8	4	0	0	0	0	0	7.8
	PM	35	14	4	0	0	1	5	0	0	0	5.9
W	AM	42	15	14	10	7	2	0	3	0	0	9.3
	PM	19	23	6	7	0	1	0	9	0	0	6.5
X	AM	32	10	7	11	5	0	0	1	4	0	7.0
	PM	23	10	6	10	0	1	0	0	0	0	5.0
Y	AM	16	22	10	3	0	0	0	0	0	0	5.1
	PM	10	20	6	0	0	0	0	0	8	0	4.4
Z	AM	31	5	10	0	0	0	0	0	0	0	4.6
	PM	21	8	3	0	0	0	5	0	5	0	4.2
Mn	AM	32.50	14.00	9.80	6.40	3.20	0.40	0.00	0.80	0.80	0.00	6.79
	PM	21.60	15.00	5.00	3.40	0.00	0.60	2.00	1.80	2.60	0.00	5.20
Mn-Mns	AM	23.50	13.00	7.50	4.20	5.00	1.20	0.20	1.00	0.40	0.00	5.84
	PM	18.20	12.10	4.00	3.80	1.30	0.30	2.80	2.00	1.30	0.00	4.58

both the initially "good" and "poor" performers. The poorer subjects showed much greater acceleration of learning during the first 15 trials than the good coordinators, (Figure 1, Table 1) but they did not learn as rapidly during the next 25 trials. The mean for trials 30 to 35 (*i.e.*, the morning run on the fourth day) for the "good" subjects was practically perfect (99.50%) while the "poor" group reached perfection (Mn = 100%) during trials 45 to 50 (afternoon of the fifth day). From that point onward, deviations from 100% average for five trials were negligible. It is interesting to note that two subjects in the "good" group learned to perfection within 25 to 30 trials (afternoon of the third day), and one subject in the "poor" group learned to perfection in 30 to 35 trials. All subjects had at least one perfect run (Mn = 100% for 5 trials) by the 45th to 50th trial session, although all men did not succeed in maintaining 100% for every succeeding session. With one exception (subject X on the 9th day = 7.8%) the deviations from Mn = 100% did not exceed 2.4%.

In ordinary selection practice, a candidate is usually given from 5 to 10 trials. Mean performance on a limited number of trials when compared with a criterion or normative score has partly or entirely determined fitness or aptitude for a given job. This practice may be thrown in doubt by the data presented here, for the following reason. Each of the initial scores of the 5 "poor" men was more than one standard deviation below the mean performance (6 trials) of a reasonably large group, (N = 93, Mean = 63.8%, sigma = 9.0) and yet all of them were able greatly to exceed the mean within 10 additional trials beyond the initial 6. The apparent speed with which learning occurs in the early trials of the test, even for the poorest men, tends to place considerable limitations upon the use of a few trials for differentiating between individuals. An example of what may happen can be seen in Table 2. Subject Z performed better than C at 15–20 trials, subject Y was better than D at 20–25 trials, and Z was better than D at 25–30 trials. Thus, at least one of the "poor" performers

exceeded the performance of one of the "good" men by 15–20 trials, and two of the poor group did better than one of the good group at 25–30 trials or earlier. It is suggested, therefore, that a minimum of 20 trials be used and the mean of the last 5 trials determine the score. Since rate of learning is probably at a maximum during the first 15 trials, it seems likely that scores taken further along the curve will provide a more reliable index of aptitude. When greater accuracy is desired, the number of trials may be increased to 45 or 50.

The extension of the number of trials appears to be especially valuable in the light of the data on individual range of performance within each succeeding five trials (Table 3). Obviously, the range tends to narrow as the scores increase, but the relative rate at which the range is reduced does not appear to follow consistently the rate of increase in proficiency. Up to 45–50 trials wide differences in the spread of scores in 5 trials appear from man to man. Therefore, it seems likely that the rate at which a subject reduces his range of error for a series of succeeding groups of 5 trials each may provide a valuable supplement to the mean scores as predictors of aptitude for this type of coordination.

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A COMPARISON OF FRATERNITY AND NON-FRATERNITY POPULATIONS WITH REGARD TO CERTAIN PERSONALITY CHARACTERISTICS

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INTRODUCTION

THE simple procedures to be described were designed and executed in an attempt to give elaborated meaning to The Adams-Lepley Personal Audit, a recently published instrument. As in the case of all such devices, only varied use can reveal the essential validities. The specific objective of these reported procedures was to discover whether or not any or all of the nine parts of The Personal Audit would differentiate populations which had been segregated by a precisely definable social process.

PROCEDURE

The Personal Audit was administered to five hundred eight undergraduate students at The Pennsylvania State College. Of the two hundred forty women, one hundred were members of, or pledges to, social fraternities. Of the two hundred sixty-eight men, one hundred five were members of, or pledges to, social fraternities. The comparisons to be made, then, are:

1. Fraternity men with non-fraternity men.
2. Fraternity women with non-fraternity women.

Since this instrument yields nine different scores there are, according to this outline, eighteen possible comparisons.

Before proceeding to these comparisons a brief description of the test is in order:

The Personal Audit is a nine-part, four-hundred-and-fifty-item self-administering instrument. The nine sub-tests are numbered and tentatively described as follows:

I. A high score indicates sociability, extroversion.
II. A high score indicates suggestibility, a tendency to agree with authority.
III. A high score indicates susceptibility to annoyance, a tendency to irritability.
IV. A high score indicates a tendency to rationalize, a tendency to make alibis and excuses.
V. A high score indicates a tendency to anxiety, a tendency to excess emotionality.
VI. A high score indicates a tendency to excessive sexual emotionality and conflicts.
VII. A high score indicates a tendency to personal intolerance.
VIII. A high score indicates a flexibility or docility of attitudes.
IX. A high score indicates a tendency to think, possibly worry, about unsolved problems.

Adams[1] in a recent article has given a complete description of The Personal Audit.

Conventional statistical procedures were used in obtaining the results shown in Table 1. In order to enhance the legibility of this table, the standard errors have been omitted.

INTERPRETATIONS

An inspection of the portion of the table concerned with the male population reveals that, according to these measures, fraternity men and non-fraternity men are more similar than otherwise. Only two of the t-values are in excess of 1.00. There is some evidence that non-fraternity men are more suggestible. There is a faint suggestion than non-fraternity men are more intolerant with regard to other persons.

[1] Adams, C. R. "A New Measure of Personality," *Journal of Applied Psychology*, Vol. XXV, No. 2, 141–151, April, 1941.

TABLE 1

A Summary Table of the Eighteen Comparisons. The t-Values Were Computed by the Following Formula:

$$t = \frac{M_{Diff.}}{\sigma_{Diff.}}$$

Part	Men						Women					
	Fraternity N = 105		Non-Fraternity N = 163		$M_{Diff.}$	t	Fraternity N = 100		Non-Fraternity N = 140		$M_{Diff.}$	t
	M	σ	M	σ			M	σ	M	σ		
I. Sociability	95.13	13.75	93.76	17.49	1.37	0.71	95.19	15.87	92.59	16.63	2.60	1.22
II. Suggestibility	36.39	12.14	39.66	12.99	−3.27	2.08	39.64	13.59	42.99	13.94	−3.35	1.85
III. Irritability	96.96	17.92	96.91	15.27	0.05	0.02	93.55	21.39	101.36	17.36	−7.81	3.00
IV. Rationalization	59.61	10.08	58.83	12.39	0.78	0.56	57.91	12.98	59.74	11.03	−1.83	1.14
V. Anxiety	57.12	24.09	54.92	22.98	2.20	0.74	59.93	23.65	66.74	24.80	−6.81	2.15
VI. Emotionality	33.11	12.64	32.46	14.53	0.65	0.39	33.16	12.48	29.31	11.76	3.85	2.42
VII. Intolerance	93.71	19.72	96.47	18.41	−2.76	1.14	99.09	20.79	107.46	18.23	−8.37	3.22
VIII. Docility of Attitudes	41.01	17.47	39.44	17.43	1.57	0.72	46.13	17.36	42.38	18.54	3.75	1.60
IX. Thoughtfulness	81.30	16.72	79.88	20.04	1.42	0.62	83.12	16.29	83.20	20.06	−0.08	0.03

The division of the table concerned with the female populations appears to reveal that:

1. Fraternity women are somewhat more sociable than non-fraternity women.
2. Non-fraternity women are more suggestible than fraternity women.
3. Non-fraternity girls are more susceptible to common annoyance.
4. Non-fraternity girls are somewhat more prone to rationalize and offer alibis.
5. Non-fraternity women tend to be more anxious or fearful.
6. The fraternity population inclines to be more "emotional" by this measure.
7. The non-fraternity population tends more to a personal intolerance.
8. The fraternity girls seem to possess a greater docility of attitudes.
9. And finally, it appears that no difference exists with regard to whatever is measured by Part IX.

These interpretations are made with the usual qualifications with regard to probability implied.

A gross comparison of these two divisions of the table presents a rather striking contrast. The table for men contains only two t-values in excess of 1.00 and only one value that exceeds 2.00. The division concerned with the female population shows eight of the nine t-values to be in excess of 1.00. Four of them are in excess of 2.00 and two equal or exceed 3.00. It is proposed that these contrasting composites reflect the differences in the selective factors at work in the segregation of these populations at The Pennsylvania State College. The two most prominent differences in the selective procedures are:

1. The pledging season for the men's organizations is during the first month of the academic year. The pledging season for the women's organizations is during the first month of the second semester. The intention here is to imply that the

longer acquaintance period makes it possible to take more precise account of personalties in the selection of female pledges.

2. All men's organizations are housed in privately managed and financed lodges. All women's organizations are housed in inexpensive university accommodations. The intention here is to imply that men's organizations are forced, by economic pressures, to give less weight to personality factors in their elections of pledges.

It may be relevant to mention that this contrast in composites appears in spite of the fact that, while only 31 per cent of Penn State men belong to fraternities, 45 per cent of Penn State women are members of such societies.

OCULAR STABILITY IN DECEPTION

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IT is commonly believed by the man on the street that deceitful persons have shifty eyes. The experiments herewith reported were designed to determine whether steadiness of fixation can be legitimately employed to supplement existing indices of deception. In spite of the wide spread popular prejudice mentioned above, studies dealing with the relation of emotional states to eye movements are singularly lacking.

APPARATUS

A standard opthalmograph as supplied by the American Optical Company was employed for recording eye movements. This instrument was originally designed for recording eye movements during reading. It employs the corneal reflection method of registration; the record being made on a 35 mm film moving at a constant speed of ½ inch per second. In order to provide a satisfactory signal record indicating when questions were asked, two slight modifications were made in the instrument. A convex reflector was mounted rigidly just below one of the forehead buttons on the head clamp in such a way that a reflected light beam could be focused on the film through one of the regular lens systems ordinarily used for recording the movements of one eye. The light sources were wired through independent switches so that the light for the stationary reflector could be interrupted whenever a question was asked.[1]

[1] Some records were made with both lens systems focused on the eyes, interrupting one of the light sources to indicate the points where questions occurred. This method is open to the objection that the subject may blink either just before or just after a question thus distorting slightly the signal record.

This necessitated the registration of the movements of only one eye.

PROCEDURE

Subjects were always examined in groups of two. When they came to the laboratory they were told briefly that the experiment was concerned with detecting deception and that one of them was to commit a "crime." The experimenter, however, remained in ignorance of the guilty person until after all the questioning of both was completed. Two sealed envelopes containing further instructions were presented to the subjects while the experimenter carefully avoided any cues that might reveal which man received which envelope. One set of instructions told the subject to take a short walk around the building and return to the laboratory at a specified time. This subject was also told to tell the truth on all questions. The second set of instructions told the subject to go to a designated point where he would find a rat that he was to kill with a knife lying nearby. He was to return to the laboratory along with the other subject and lie on all questions pertaining to the deed or in anyway connecting him with it. An alternative "crime" was used at times which called for the criminal to search in the shavings of a rat's cage for some money. In this case the subject was informed he could keep the money if he successfully deceived the experimenter.

Upon their return to the laboratory the experimenter questioned the subjects individually. The "suspect" was required to place his head in the normal position in the opthalmograph and was instructed to answer all questions with finger signals. This requirement was necessary to avoid head movements caused by opening the mouth during a verbal response. A movement of the right index finger meant "yes"; movement of the left index finger meant "no"; movement of both together meant "I don't know." Practice in answering simple questions with finger movements was given until the task became quite automatic.

In the early trials the subjects were asked six or seven questions, approximately half being control and half crucial questions pretaining directly to the crime. Later the question period was reduced in length so that not more than 1 noncrucial and 3 crucial questions were asked. In the latter cases the questioning period lasted for not more than 70 seconds. During the questioning the subject was instructed to look steadily at a designated spot on an otherwise blank 3 by 5 card, held approximately 16 inches from his eyes.

Following the question period a rest of approximately 1 minute was permitted, after which the subject again fixated the same point for another minute. During this time no questions were asked and the subject expected none. Partly as an economy measure and partly to facilitate later comparisons, the recording mechanism operated only during the first and last 15 seconds of this "silent period."

In all, 46 subjects participated. Six of these records had to be discarded either because of poor photographic technique, failure to follow instructions or other extraneous complicating circumstances. Thirty of the remaining subjects were college students; ten others were drawn from the C.C.C. and migrant farm workers. All subjects were male. Twenty were "innocent" and twenty were "guilty."

RESULTS

After considerable study of the records it became quite evident that either the method or the instrument employed did not reveal significant differences between control and crucial questions. Instead, therefore, of comparing the reactions to specific questions with each other we enlarged the area of examination to include the entire question period as contrasted with the entire silent period. Further study seemed to show that a large proportion of guilty records decreased in irregularities during the silent period. The differences that were noted, however, were of such slight magnitude that objective measurement of the amplitude or frequency of irregularity

appeared impractical. Accordingly, the records were submitted to five judges who had no knowledge of the subjects' innocence or guilt. These judges were asked to look at the records taken during the silent period and determine whether the irregularities increased, decreased, or remained the same in the last 15 seconds as compared with the first 15 seconds. These estimations were somewhat refined by requiring the judges to evaluate the frequency separately from the amplitude of irregularity. In other words, the judges determined whether the amplitude of tremor[2] changed and then later made a similar determination in regard to frequency.

Our criterion of guilt was a decrease in amplitude or frequency of irregularity or both during the silent period. Records which showed either no change or an increase in these features were considered indicative of innocence. When these criteria of innocence and guilt were applied to the estimations made by the five judges and the author the following table of diagnoses resulted. That is to say, if for example, judge L.R.

TABLE 1

Summary of Diagnoses of Guilt and Innocence Based on Records of Visual Fixation

Judges	Diagnosed guilty		Diagnosed innocent		Per cent correct	Ambiguous records	
	Correct N	Incorrect N	Correct N	Incorrect N		N	%
L.R.	14	5	13	5	72	3	7.5
C.Y.	12	5	13	5	71	5	12.5
J.P.	10	3	13	5	74	9	22.5
W.B.	8	4	15	9	64	4	10.0
A.B.	14	7	10	5	67	4	10.0
FKB.	14	3	16	6	77	1	2.5

had been forced to declare each man either guilty or innocent on the basis of the criteria mentioned above he would have

[2] Saccadic movements occurred very rarely in the silent period and were not considered in making these judgments.

made 14 correct and 5 incorrect diagnoses of guilty; 13 correct and 5 incorrect diagnoses of innocent. According to his judgment 3 records showed an increase in either frequency or amplitude while the remaining feature in each decreased. Quite evidently, such records were ambiguous according to our criteria.

An examination of this table reveals a rather high consistency in the per cent of correct diagnoses. This consistency takes on added importance in light of the fact that L.R. and C.Y. are professional psychologists; J.P. and W.B. are undergraduate students; and A.B. is a housewife. None of these judges had had special training in making estimates of the kind required in this study and none except the author had previously given the records more than a cursory glance.

The evidence in this table appears to indicate that the average untrained person can determine the guilt or innocence of an individual suspected of a "laboratory crime" on the basis of the fixation records with an accuracy of about 70 per cent. In general approximately 12 to 15 per cent of all records encountered fall in the ambiguous category, showing conflicting trends in amplitude and frequency of irregularities.

The data can be treated from a different angle. We can suppose that a given man's diagnosis may depend not upon the judgment of a single individual but upon the consensus of opinion of a group of individuals. Proceeding on this line of reasoning, the diagnoses made from the estimates of each of the judges for each of the subjects are summarized in Table 2. It is evident that the weight of opinion in all but 8 cases is in agreement with the facts. If the final diagnosis, then, is determined by the most frequent diagnosis given by the six judges the accuracy for the method reaches 80 per cent.

DISCUSSION OF RESULTS

It was somewhat surprising to the experimenter to discover that guilty individuals tended to surpass innocent persons in

TABLE 2

Distribution of Diagnoses Made by Six Judges According to Subjects

Guilty subjects				Innocent subjects			
Subject	No. of times diagnosed: Guilty	Innoc.	Ambiguous	Subject	No. of times diagnosed: Guilty	Innoc.	Ambiguous
Grab	6			Letz	1	3	2
Goew	6			Brow	2	4	
Chie	4		2	St. J*	6		
Grav*	1	4	1	Knep		5	1
Leve*	1	5		Fews	1	5	
Muns	3	1	2	Rasi		6	
Benj	4	1	1	Case	2	3	1
Reid	5	1		Quic	1	5	
Cadm	4	1	1	Swan	1	4	1
Arte*		6		Rizz*	4	2	
Cole	5		1	Thom		6	
Phil*		5	1	Barr*	4	1	1
Dile	6			Mike		6	
Pric	5		1	Herm	1	5	
Bran	4	2		Call	2	4	
Covn	6			Hind		6	
Gadz	5	1		Wein	1	3	2
Huda	3	2	1	O'Ma	1	3	2
Quee*	1	5		Byrn		4	2
Sura	3	1	2	LaNa		5	1

* Cases in which consensus of diagnoses is contrary to the facts.

the steadiness of their fixations during the silent period. Two lines of thought, however, have tended to explain this rather unusual finding. In the first place, the guilty persons tend to have less steady records during questioning than the innocent, even though the differences in this regard are not as indicative of guilt or innocence as the criteria just described. Consequently, the guilty start the silent period with greater opportunity for decreasing their irregularities than the innocent persons. The latter on the other hand, frequently start the silent period with virtually no ocular tremor and for that reason cannot improve much in this respect.

We are still left with the task of explaining the reasons for the guilty improving in fixating rather than becoming less stable. It appears likely that the physiological changes accompanying emotion are related to this performance. All who have worked in the field of detecting deception are aware that the indices employed are essentially related to bodily changes. The assumption in all such work is that the deceiving person will react more violently especially to particular questions than the one telling the truth. It is known that the bodily changes accompanying emotions ordinarily associated with lying are such as to provide more than normal energy and/or neutralize the effects of fatigue. In the light of these considerations it is quite possible that guilty persons start the silent period with greater unused energy than innocent persons and thus are capable of maintaining greater ocular control.

This hypothesis finds additional support in another feature of the records. Our instructions were such as to discourage blinking at any time. In spite of these instructions blinking did occur infrequently. A few more innocent individuals showed such blinks particularly in the last 15 seconds of the silent period than guilty persons. If we assume that blinking is evidence of fatigue, then this finding corroborates the hypothesis above.

It may be objected that our procedure is significantly different from actual criminal cases in two respects: First, the innocent individual in the laboratory crime is unaware of the nature of the offense until the questioning is finished. Second, the suspects are questioned within a very short time after the offense has been committed. Both of these conditions are rarely encountered in bona fide criminal cases. In order to determine the importance of the first of these objections 8 of the 20 laboratory crimes were committed after both subjects had been told the general nature of the offense. The 16 men involved in these 8 crimes were no more difficult to diagnose

than the remaining 24. With regard to the second objection only one opportunity was presented to test the influence of a delay between committing the offense and the examination. In this case both men returned to the laboratory at the appointed time but circumstances were such that the examination could not be held until two days later. These subjects were Hind. and Covn. who were correctly diagnosed by all judges (see Table 2). Apparently neither of these objections to our procedure is important.

One attempt was made by an innocent person to appear guilty. He was unaware of the criterion of guilt and consequently made marked voluntary movements. Such saccadic movements are easily distinguished from the wavy tremor characteristic of unstable fixation.

The results of this exploratory study compare favorably with the efficiency of other indices of guilt currently employed by forensic psychologists. Systolic blood pressure according to Marston's study[3] based on 107 records made by 10 subjects gave an accuracy of 96 per cent. Chappell[4] using the same measure reported correct diagnoses in 87 per cent of the cases. Burtt[5] found the I/E ratio to be 73 per cent accurate in his most favorable series of experiments. Burtt[6] also found the Luria technique provided criteria that permitted correct identification of the guilty and innocent in 69 per cent of 29 cases. Directly comparable percentages for the galvanic phenomena are not available. The percentage accuracy for the opthalmograph of 70 to 80 indicates the technique is worthy of trial by the "field workers" dealing with police cases.

[3] Marston, W. M. Systolic blood pressure symptoms of deception. *Jr. Exper. Psychol.* 1917, 2, 117–163.

[4] Chappell, M. N. Blood pressure changes in deception. *Arch. of Psychol.* 1929, 17, No. 105.

[5] Burtt, H. E. Inspiration-expiration ratio during truth and falsehood. *Jr. Exper. Psychol.* 1921, 4, 1–25.

[6] Burtt, H. E. Motor concomitants of the association reaction. *Jr. Exper. Psychol.* 1936, 19, 51–63.

SUMMARY AND CONCLUSIONS

A method has been described whereby the opthalmograph may be employed for recording stability of visual fixation during questioning. The essential problem has been to investigate the validity of the method for detecting deception. A study of 40 male subjects, 20 of whom were guilty of a "laboratory crime" and 20 innocent, has revealed that the most significant distinguishing feature was the change in stability of fixation during the silent period following a short series of questions. Persons without special training in judging the records have been able to diagnose guilt and innocence from the records with accuracies ranging from 64 to 74 per cent. When the final diagnosis of a given record depended upon the consensus of opinion of a group of six judges, the accuracy of the method has been shown to reach 80 per cent. Neither a period of delay between commission of the offense and examination nor heresay knowledge of the offense appears to have adverse effects on the method's validity. An hypothesis has been offered to account for the fact that guilty persons improve in ocular stability.

STATED VOCATIONAL AIMS AND STRONG INTEREST TEST SCORES OF HIGH SCHOOL SENIOR GIRLS

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PROBLEM

VOCATIONAL counseling of high school seniors is usually based on evidence of school achievement as shown by marks, the curriculum completed and the student's stated vocational ambition. Intelligence test scores, where available, are also considered, but the use of interest tests is a less general practice. The tendency is to limit their application to problem cases with apologies for not having the funds to make them available to all graduates. The opportunity to view the results of objective tests of a group of seniors representing the entire class, not just the "problems," is valuable since it may throw considerable light on the merits of certain interest tests for counseling in general.

DESCRIPTION OF SAMPLE

As part of a demonstration in educational and vocational guidance, sponsored by the Institute for Human Adjustment of the University of Michigan, a survey was made of the June, 1939, graduating classes of the two public high schools of Flint. The survey had two general objectives: 1) To determine whether differences among the various curricula could be detected by means of standardized tests, and 2) to evaluate the results and values of tests and inventories which were being considered for use with a long-time project in guidance. Included in the survey were the Kuhlmann—Anderson group test

of intelligence, the Revised Minnesota Paper Form Boards, the Minnesota Vocational Test for Clerical Workers, the Detroit Mechanical Aptitude tests, Bell Adjustment Inventory, Strong Vocational Interest Blanks, and two personal information blanks.

Since it was impractical to administer the entire battery of tests and information blanks involving about six hours of testing time per student to the entire class of 1400, a representative sample was selected. The schools offer ten curricula: College Preparatory divided into pre-arts, engineering and medicine-nursing; Commercial divided into secretarial, bookkeeping, selling; General; Industrial Arts; Home Economics; and Technical. Since certain comparisons among curricula were desired, the first selection was on this basis. In curricula where the total senior enrollment was thirty or less, all were included. Where the enrollment was greater, the students were ranked according to grade point ratio and every second or third student was selected so the sample for that curriculum was at least 30. This resulted in a total sample of 285 boys and 297 girls, proportionally distributed for the two high schools. For the purpose of this paper, dealing only with the girls in the study, all Pre-College students were included in one group, all Commercial students in another, and General and Home Economics students in the third.

The social setting of the group is that of an industrial city of 165,000 with a single major industry. The students represent all geographical and socio-economic groups in the city.

PROCEDURE

The Kuhlmann-Anderson group test was used as a measure of mental ability. Sixteen years was used as a maximum divisor. Mean IQ for the girls was 105 with a standard deviation of 13.7, and the range was from 73 to 156. The distribution of IQ's by curricula is shown in Table 1. The usual pattern of relatively higher ability in the college preparatory and relatively lower in the general group is found here as in

TABLE 1

Distribution of Kuhlmann-Anderson IQ's of 297 Representative Senior Girls, Flint, Michigan

	CP	CC	Gen.	Total
150–159	1	—	—	1
140–149	1	—	—	1
130–139	12	2	—	14
120–129	16	16	1	33
110–119	23	24	5	52
100–109	22	40	26	88
90–99	11	45	21	77
80–89	—	11	16	27
70–79	—	—	4	4
N	86	138	73	297
Mean	113	104	96	105
S.D.	13.0	11.8	11.1	13.7

most schools. However, there is a considerable degree of overlapping. In the rest of this discussion the group has been divided into those with IQ's above 110, those with IQ's between 109 and 90, and those with IQ's of 89 or less.

As a measure of vocational interests the Strong Vocational Interest Blank for Women was selected. Strong, reasoning from experience with the men's blank, warns that occupational interests of women under 25 should be evaluated with caution. However, the experiences of Carter and Strong (1), and others indicate that girls mature in vocational as well as other interests at a somewhat younger age than boys. Since the girls in this study were between 16 and 23 years of age, the majority between 18 and 20, it was felt that the youth of the subjects presented no serious difficulty.

The Blank is too well known to require description. The individual's scores are in essence compared to those of persons already engaged in a particular occupation, and the degree of similarity of interest patterns is indicated by letters, "A" indicating very high similarity and "C" low. Strong states in his manual that the score "is a measure of how nearly a

woman's interests coincide with those of the average woman successfully engaged in a given occupation. . . . Relatively few rate A in any occupation outside the group to which their occupation belongs; consequently, one can recommend for serious consideration any occupation in which the individual rates A. . . . In general, a person should consider seriously those occupations in which she receives A or B + ratings before entering some other occupation'' (5).

In this study the blank was scored for 14 occupations for which keys were available as shown in the tables. Only A ratings are discussed in this paper.

The stated vocational choices were tabulated from three sources on the various blanks where a statement of vocational plans was requested. The girls were not limited in the number of choices made. All separate choices, but not duplicates, were included in the analysis since it was felt that an individual could well have more than one vocational goal which she recognized, just as she could have more than one A rating on the Strong Blank.

DISTRIBUTION OF STATED VOCATIONAL AIMS BY INTELLIGENCE AND SCHOOL CURRICULUM

Twelve, or 4 per cent, of the 297 girls did not give a single vocational choice. They could not be distinguished from those who did give a choice on the basis of either intelligence, curriculum or scores on the Strong test. The number of choices ranged from none to five, with most girls giving two, usually quite closely related, occupations. A total of 575 choices was named. They are distributed by IQ levels as indicated in Table 2. The stated vocational choices were easily grouped into office work, arts and self-expression, nursing and scientific, teaching and social work, personal service, sales, skilled trades, adventurous occupations, miscellaneous professions and housewife.

Both the actual members and the percentages of choices are shown in the table which is read as follows: 53 of the choices

TABLE 2

Number and Percentage Distribution of Stated Vocational Choices by IQ Classification, Senior Girls

	IQ				Per cent of choices			
	110+	109–90	89–	Total	110+	109–90	89–	Total
Office work	53	73	13	139	26	23	25	24
Arts & Expr.	33	56	4	93	16	18	8	16
Nursing & Sci.	41	35	4	80	20	11	8	14
Teach. & Soc. Wk.	35	37	2	74	17	12	4	13
Personal Serv.	13	40	13	66	6	13	25	11
Sales	9	40	7	56	4	12	14	10
Skilled trades	2	12	6	20	1	4	12	3
Adventure	5	9	1	15	2	3	2	3
Misc. Prof.	10	7	1	18	5	2	2	3
Housewife	4	10	.....	14	2	3	0	2
Total choices	205	319	51	575	99	101	100	99
No choice	6	5	1	12				
No. of girls	101	165	31	297				

made by girls with IQ's of 110 or above were in the field of office work, constituting 26 per cent of the choices made by superior girls. Seventy-three, or 23 per cent, of the choices made by girls with IQ's in the 90–109 group were in office work, while 13, or 25 per cent, of the choices of girls of below average ability were in this field. All together 139, or 24 per cent, of the 575 choices made by the 297 girls were in office work. Interest in this field cuts through all the ability levels in practically the same degree. Interest in the arts, nursing and teaching, however, is principally found in the superior group and to some extent in the average group. Sixteen, 20 and 17 per cent of the choices of superior girls were in these fields in contrast to those of below average ability; only 8, 8 and 4 per cent of whose choices were in these areas. It is interesting to note the low percentage of stated interest in the teaching field among this group. Other studies have reported as high as 37 and 44 per cent of the girls interested in teaching (2).

The next three groups of occupations are of primary interest to the girls of below average ability. Only 6 per cent of the choices of superior girls are in the field of personal service, 4 per cent in sales and 1 per cent in skilled trades as contrasted to 25 per cent, 14 per cent and 12 per cent of the choices of girls of lesser ability. In the remaining three occupations the number of choices was small. Adventure and housewife are found with practically equal frequency at all levels, and miscellaneous professions are more often mentioned by superior girls.

Except in the field of office work it is apparent that girls of below average intelligence are realistic in their vocational choices. The occupations requiring training beyond their abilities make no particular appeal.

Table 3 shows the distribution of percentages of choices by

TABLE 3

Distribution of Percentages of Choices by Ability Level and Curricula, Senior Girls

	CP			CC			Gen.		
	110+	109–90	89–	110+	109–90	89–	110+	109–90	89–
Office work	13	8		41	38	53	25	11	9
Arts & Self-Expr.	18	23		14	12	5	19	22	9
Nursing & Sci.	26	25		15	3	5	6	12	9
Teach. & Soc. Wk.	27	23		5	8	....	19	8	6
Personal Serv.	4	3		8	13	5	13	20	38
Sales	4	8		6	14	26	....	13	6
Skilled trades	....	1		2	3	....	....	8	19
Adventure	2	4		3	3	5	....	2	....
Misc. Prof.	4	4		5	1	....	13	2	3
Housewife	2	1		1	5	....	6	1	....
Total	100	100		100	100	99	101	99	99
No. of girls	53	33		42	85	11	6	47	20

both intellectual level and high school course pursued. Guidance into these courses had been primarily on the basis of the

student's choice. Students failing in any one course were advised to change to less difficult programs but tests of academic, clerical or other aptitude were not available for these students while in high school. The Table is read as follows: Among students taking the college preparatory course, 13 per cent of the stated interests of superior girls and 8 per cent of the interests of average girls were in office work. Among girls taking the commercial course, 41 per cent of the interests of superior girls, 38 per cent of those of average girls, and 53 per cent of those of below average girls were in the field of office work.

Certain of the figures are of special interest. The girls of average ability in the college preparatory and general courses are the ones who contribute heavily to the high interest in the arts. The college preparatory girls both of average and above average ability are largely responsible for the interest in nursing and teaching.

Twenty per cent of the choices of average and 38 per cent of those of below average girls in the general course are in personal service occupations. The total per cent of stated interest in sales is largely influenced by the 26 per cent of below average girls who completed commercial courses. This is also true in the case of the skilled trades where are found 19 per cent of the stated interests of below average girls in the general course.

These results may be summarized as follows:

1. Approximately one-fourth of all the stated interests of girls of all levels of ability are in the field of office work.

2. Interest in nursing and medical sciences, teaching and social work is primarily found among superior and average girls with college preparatory training.

3. Interest in personal service, sales, skilled trades, is more frequently found among the average and below average girls with commercial and general course training than among superior girls or average girls with college preparatory training.

DISTRIBUTION OF STRONG "A'S"

An analysis of the Strong blanks showed that 21 girls had

no A ratings and 276 had from one to five with a total of 852 A's. They were tabulated by IQ levels as shown in Table 4.

TABLE 4

Number and Percentage Distribution of Strong A's by IQ Classification, Senior Girls

	Number				Per cent			
	110+	109–90	89–	Total	110+	109–90	89–	Total
Housewife	75	142	28	245	28.5	28.5	31.8	28.8
Stenographer	73	127	26	226	27.7	25.5	29.5	26.5
Office worker	74	123	23	220	28.1	24.7	26.1	25.8
Nurse	34	86	10	130	12.9	17.3	11.4	15.3
Math. Teach.	6	5	....	11	2.3	1.0	....	1.3
Soc. Stud. Teach.	....	3	....	3	....	0.6	....	0.4
HS Eng. Teach.	2	1	....	3	0.8	0.2	....	0.4
Y.W.C.A. Sec'y	....	5	....	5	....	1.0	....	0.6
Dentist	1	3	....	4	0.4	0.6	....	0.5
Lawyer	....	2	1	3	....	0.4	1.1	0.4
Social Worker	....	1	....	1	....	0.2	....	0.1
Life Ins. Sales	1	....	....	1	0.4	....	....	0.1
Physician	....	....	....	....	....	....	....	....
Librarian	....	....	....	....	....	....	....	....
Total A's	266	498	88	852	101.1	100.0	99.9	100.2
Zero A's	10	10	1	21				
No. of girls	101	165	31	297				

Again the raw numbers are on the left and the percentages on the right. The table is read as follows beginning with housewife: Of the 266 A's made by girls with IQ's of 110 and above, 75 were in the field of housewife. This constitutes 28.5 per cent of all the A's made by superior girls. Likewise, 28.5 per cent of all A's made by average girls, 31.8 per cent of all those of below average girls, and 28.8 per cent of all A's were in this field. The figures for all intelligence levels for the three occupations of housewife, office worker and stenographer-secretary are essentially the same. They are closely followed by the percentage for nurses which includes 15 per cent of all the A's

achieved. These four occupations include 96.4 per cent of all the A's. The remaining 3.6 per cent of A's are distributed over eight occupations. No girl received an A as physician or librarian. There were one each in insurance and social work, 4 in dentistry, 3 in law, 5 in Y.W.C.A. work, and 17 altogether in the three teaching fields.

As with the stated choices, the A's were tabulated in Table 5

TABLE 5

Percentage Distribution of Strong "A's" by Ability Level and Curricula, Senior Girls

	CP			CC			Gen.		
	110+	109–90	89–	110+	109–90	89–	110+	109–90	89–
Housewife	27.6	24.7		28.8	28.5	30.0	27.3	30.9	32.8
Stenographer	25.2	21.4		29.6	26.7	30.0	27.3	25.9	29.3
Office worker	26.0	23.6		30.3	26.7	30.0	18.2	21.6	24.1
Nurse	14.6	20.2		10.6	16.3	10.0	18.2	17.3	12.1
Math. Teach.	4.1	3.4		.....	.4	.....	9.1	.7	.....
Soc. Stud. Tea.	.....	.....		.....	.4	.....	.....	1.4	.....
HS Eng. Teach.	1.6	.....		.....	.....	.....	.....	.7	.....
Y.W.C.A. Sec'y	.....	1.1		.....	.7	.....	.....	1.4	.....
Dentist	.8	2.2		.....	.4	.....	.....	.....	.....
Lawyer	.....	2.2		.....	.....	.....	.....	.....	1.7
Social Wk.	.....	1.1		.....	.....	.....	.....	.....	.....
L. Ins. Sales.	.....	.....		.8	.....	.....	.....	.....	.....
Physician	.....	.....		.....	.....	.....	.....	.....	.....
Librarian	.....	.....		.....	.....	.....	.....	.....	.....
Total	99.9	99.9		100.1	100.1	100.0	100.1	99.9	100.0
No. of girls	53	33		42	85	11	6	47	20

according to IQ level and school course completed and converted into percentages. Here again the four fields of nurse, stenographer, office worker and housewife are present in substantially the same proportions at all intellectual levels and in all curricula.

It might be anticipated that the more intelligent girls who

more frequently expressed an interest in the professions and occupations requiring advanced training might also receive the larger number of A's falling outside the characteristic pattern for this group. Inspection of the table shows that this is not the case.

An analysis of the relationship between stated choices and Strong A's showed nothing since the predominant pattern of stenographer, office worker, housewife and nurse overwhelmed all other differences.

CONCLUSIONS

The results of this study show that approximately one-fourth of the stated vocational choices of high school senior girls, regardless of intellectual level, are in office work. Except for this occupation, when both intellectual level and high school course are considered, the stated choices of the girls are reasonably realistic on the basis of their abilities to meet the requirements of their chosen occupations.

The fact that the A ratings on the Strong are concentrated in the four occupations of stenography, office work, homemaking and nursing raises several problems in the use of this test in counseling. At a time when vocational guidance is needed the most, when students are leaving school, this blank offers little or no assistance in the choice of an occupation. The lack of discrimination may be the result of inadequate validation and standardization. It is also possible that the vocational interest patterns of women in stenography, office work, homemaking and nursing are so general that they are shared by a large proportion of high school seniors. It might be suspected that girls who have A ratings outside the usual pattern could be guided into the indicated fields with a fair degree of confidence. Analysis of the individual cases, however, showed that in most cases the girls lacked either the ability or the expressed interest to pursue these careers.

The argument may be advanced that the subjects of this study were too immature. Yet not only were they sufficiently mature for society to expect them to take jobs, but the interests

of girls have been found to be consistently more mature than those of boys of the same age. Therefore it is reasonable to assume that if the interests of boys are sufficiently mature for guidance at 15 (4) those of girls at 18 certainly should be identifiable. This does not, nowever, preclude the possibility that the interest patterns of mature women such as probably constituted Strong's criterion group, might have become more sharply defined through years of experience in specific occupations. It is possible that this test may be a measure of the results of experience and be of some value with women well beyond the high school years. The fact that established professional women (3) do have a high proportion of A's in their chosen fields points in this direction.

It may be concluded that the Strong Vocational Interest Blank for Women has less guidance value at the high school level than the stated occupational choices of the students themselves.

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A COMPARISON OF THE MINNESOTA VOCATIONAL TEST FOR CLERICAL WORKERS WITH THE GENERAL CLERICAL BATTERY OF THE UNITED STATES EMPLOYMENT SERVICE

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NO one who has read the report by Stead, Shartle, and their co-authors,[1] of the work done in the Occupational Research Program of the United States Employment Service can fail to be impressed both by the quantity and extensiveness of the research. The fact that the writer has noted the report on the desks of Civil Service Personnel officers, WPA classifiers, State Employment Board counselors, and personnel officers in private business, bears witness of its importance. It is not surprising, then, that the findings have been subject to considerable discussion among practitioners.

One of the things in the report on which the writer's opinion has been sought a number of times, particularly by counselors, is the general battery of tests for clerical workers which is described in the chapter by Dr. R. M. Bellows. This battery consists of the number and name checking items of the Minnesota Vocational Test for Clerical Workers, and number writing, arithmetic, and letter-digit substitution items developed by the Worker Analysis section of the Employment Service. In validating this general battery, the scores on it made by 562 clerical workers in a number of different jobs were correlated with criterion measures of their job success, job success being measured either by production records or work sample

[1] Stead, W. H., Shartle, C. L., *et al.*, *Occupational Counseling Techniques*, N. Y.: American Book Co., 1940. The writer wishes to express his appreciation to Dr. R. M. Bellows for suggestions and criticisms.

tests. The average of the validity coefficients of this battery is given as .42, and its validity as reported for each of the clerical groups used as subjects is shown in the first column of figures in Table 1. It will be observed that the validity coefficients shown in this column range from .12 to .64, and

TABLE 1

A Comparison of the Validity of the Employment Service General Clerical Battery with that of the Minnesota Vocational Test for Clerical Workers for Several Clerical Groups

	N	Employment Service Battery	Minnesota Clerical Test
Adding machine (ten key) operators	26	.50	.48
Bookkeeping machine operators	52	.12	.05
Calculating machine operators	80	.46	.39
Card punch machine operators	121	.39	.35
Calculator (key actuated) operators	81	.64	.40
Coding clerks, Sample I	98	.48	.46
Coding clerks, Sample II	42	.39	.37
Hand transcribers	62	.20	.29

are sufficiently high in most cases with these varied jobs so that the battery truly can be described as an occupational test, measuring aptitude in a family of jobs.

It is just for this purpose, prediction of success in an occupation rather than in a specific job, that counselors have been making use of the Minnesota Clerical test alone. The question counselors ask is, Since the Employment Service included items other than the Minnesota number and name checking in their general battery, does this mean that the Minnesota test is inadequate as a measure of general clerical fitness when used alone?

To answer this question, the validity coefficients of the Minnesota test may be compared with those of the Employment Service battery for the various clerical groups described in the report. The counselor using the Minnesota test will give

more emphasis to an individual's score on one or the other of the two subtests depending upon the specific nature of the job for which he is being considered. However, when general clerical aptitude is the prime consideration, the two subtests will be given equal weight. In combining the scores on the two subtests, then, we shall consider that they will carry equal weight in the total score. The formula for estimating the validity of the combined and equally weighted scores is

$$r_{0(1+2)} = \frac{\sigma_0 \sigma_1 r_{01} + \sigma_0 \sigma_2 r_{02}}{\sigma_0 \sqrt{\sigma_1^2 + \sigma_2^2 + 2\sigma_1 \sigma_2 r_{12}}}$$

where the variables 0, 1, and 2 are respectively the criterion of job success, the number checking test, and the name checking test. Since Bellows would have had to transmute the criterion scores of each of the different clerical groups into comparable distributions in order to combine them into a single distribution, we may consider the criterion scores as standard scores, and consequently their standard deviation will be unity. Since the scores on each of the two Minnesota subtests are to carry equal weight, they, too, may be considered standard scores with standard deviations of unity. The above formula, therefore, will resolve to

$$r_{0(1+2)} = \frac{r_{01} + r_{02}}{\sqrt{2 + 2r_{12}}}$$

The values for $r_{0(1+2)}$, the validity of the total Minnesota Clerical test, are given in the second column of Table 1. In computing these values, the coefficients of correlation between the two separate Minnesota subtests and the criterion for each clerical group were taken directly from the tables presented in Bellows' chapter and from the appendix of the report. The coefficient of correlation between the scores on the two subtests is taken as .70. Although the actual coefficients of correlation for the clerical groups studied are not given in the report, a coefficient of .69 is described for a group of 113 operators of card punch machines (p. 104), and .76 for a group of 153 department store salespersons (p. 130). Most of the investigators who have used the Minnesota Clerical test report

the coefficient of correlation between the number and name checking items to be around .70. The writer has obtained coefficients ranging from .65 to .70 for some 500 cases. Obviously it is necessary to have an adequate value for the coefficient of correlation between the subtests, since if a value which is too low is used in the formula the validity coefficient of the total test will be too high, and if one which is too high is used the validity coefficient will be spuriously low. Since .70 appears to be a fair estimate of the coefficient of correlation between the two Minnesota subtests, it was used in calculating the coefficients given in Table 1. However, the validity coefficients for the Minnesota test also were calculated assuming this value to be .65, and assuming it to be .75. In no case did a coefficient vary more than .01 from that obtained using a value of .70, and these differences existed only for three groups using the lower value, and for four with the higher one. Obviously a variation of .05 from the value used here will not have any appreciable effect.

A comparison of the coefficients in Table 1 will reveal that in only three of the eight cases is the validity of the Minnesota Clerical test appreciably lower than that of the Employment Service battery, and in one case it is even higher. The two tests also may be compared in terms of forecasting efficiency ($E = 1 - \sqrt{1 - r^2_{01}}$). The forecasting efficiencies of the two tests for the various clerical groups studied are shown in the first two columns of Table 2. Although the Employment Service battery is superior in all but one of the eight cases, there is a marked difference in just one instance. On the average the Employment Service battery is superior to the Minnesota Clerical test by only 3 per cent.

Taylor and Russell[2] have prepared useful tables from which one may gauge the effectiveness of a test in terms of the per cent of correct placements. Using these tables, the predictive

[2] Taylor, H. C., and Russell, J. T., "The Relationship of Validity Coefficients to the Practical Effectiveness of Tests in Selection: Discussion and Tables," *J. Appl. Psychol.*, 1939, 23, 565–578.

TABLE 2

A Comparison of the Predictive Effectiveness of the Employment Service General Clerical Battery with that of the Minnesota Vocational Test for Clerical Workers for Several Clerical Groups

	Forecasting efficiency		Per Cent above average on test who are above average on criterion	
	Employment Service Battery	Minnesota Clerical Test	Employment Service Battery	Minnesota Clerical Test
Adding machine (ten key) operators	13%	12%	67%	66%
Bookkeeping machine operators	1	0	54	52
Calculating machine operators	11	8	65	63
Card punch machine operators	8	6	63	61
Calculator (key actuated) operators	23	8	75	63
Coding clerks, Sample I	12	11	66	65
Coding clerks, Sample II	8	7	63	62
Hand transcribers	2	4	56	60

efficiency of the two tests for each group has been estimated in terms of the per cent of individuals obtaining a score better than the average on the test who are above average on the criterion of job success. These percentages for the two tests are shown in the third and fourth columns of Table 2. Again, in the seven of the eight cases where the Employment Service battery is superior, it is markedly so in only one instance. On the average 64 per cent of individuals who achieve a better than average score on the Employment Service battery fall above average on the criterion measure of job success, and 62 per cent of the individuals do so in the case of the Minnesota Clerical test. This means, that in these terms the Employment Service battery would correctly place only two more persons out of one hundred than would the Minnesota test.

The present analysis, then, indicates that although the addition of other tests to the Minnesota Clerical test will give a better measure of occupational fitness than the Minnesota test alone, the increased effectiveness is very small. In view of the fact that for at least two of the tests added by the Employment Service, the number writing and letter-digit substitution test, no adequate norms are available for adult populations, there will be little point at the present time for counselors to use other than the Minnesota Clerical test for the classification of individuals for fitness for general clerical work.

THE RELATIVE IMPORTANCE OF HOMOGENEITY AND DIFFICULTY IN THE DEVELOPMENT OF MENTAL FATIGUE AT TWO DIFFERENT LEVELS OF INTELLIGENCE[1, 2]

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THIS study is concerned with an attempt to determine whether difficulty and homogeneity are factors which influence the development of mental fatigue. If one or the other, or both, is found to operate as such factors, then, this experiment is further designed to discover its relative importance at two different levels of intelligence. Incidentally it is hoped that this experiment will provide an answer to the question of whether or not individuals with superior intelligence develop mental fatigue, in the presence of particular conditions, more readily than those with normal intelligence, under the same conditions, or whether the reverse is true.

Two groups of college men and women were used for the experiment. The groups were about equally divided on the basis of sex. The members of one group all obtained scores on the Otis Self-Administering Test of Mental Ability which indicate intelligence quotients which range between 122 and 133. The scores attained by those in the other group indicate intelligence quotients which range between 95 and 110. The groups were each subdivided into four divisions in order that the conditions of the experiment might be presented in varied order.

[1] From the psychological laboratory of the University of Cincinnati.

[2] The author is indebted to Dr. A. G. Bills for his cooperation throughout the experiment.

Four kinds of mental work constitute the conditions of the experiment. One is relatively easy and heterogeneous, one relatively easy and homogeneous, another relatively difficult and heterogeneous, and the fourth is difficult and homogeneous.

Before the experiment could be undertaken, it was necessary to find some manner of both producing and measuring mental fatigue. The author felt that the solution of analogies, presented visually, involves a more fundamental aspect of intelligence than multiplication, cancellation, color naming and completion which frequently have been used and that continuous work at their solution should bring about a measurable amount of mental fatigue in a limited time. Furthermore, it might be found that fatigue produced in this manner might be in some way related to the level of intelligence of the individual.

In the search for an adequate method of measuring fatigue, it was found that Oehrn (1) probably made the first attempt to determine and analyze the work curve of mental functions. He measured, objectively, the efficiency of certain mental functions, by permitting his subjects to carry on continuous mental work for some time and to mark their work sheets at five-minute intervals, so that the amount of work done during that period might be determined. He suggested that the subject be allowed to work until the curve representing his work showed decided decrement. Then, if the values of the maximum and minimum points of efficiency are determined, they may be substituted into the following formulae which he presented:

$$\text{Fatigue} = \frac{(M - m_2) \times 100}{M}$$

$$\text{Practice} = \frac{(M - m_1) \times 100}{M}$$

The method which Oehrn has outlined, proved to be unsatisfactory for use in the present experiment because it assumes that

[3] M = The value of the point of maximum efficiency.
m_1 = The value of the first point of maximum efficiency.
m_2 = The value of the second point of maximum efficiency.

in the presence of fatigue, there is an apparent drop in the work curve. However, this need not be the case; in many curves, the effect of practice may obscure the influence of fatigue entirely.

It was found that Arai (2) too, has presented a method of measuring fatigue based on the assumption that practice must be allowed to develop to a degree of maximum value before the effect of fatigue can be measured. She suggested that fatigue could be indicated in terms of decreased amount of work which could be done in a given length of time or in terms of increased time required to do a certain amount of work. On the basis of this, she proposed two formulae, neither of which proved suitable for this study because of the comparatively short length of the work period which was employed here. She pointed out that a coefficient of fatigue might be obtained by substituting the proper values in the following formulae:

Coefficient of fatigue $= \frac{(T_2 - T_1) \times 100}{T_1}$ [4] when fatigue is measured as a function of the time required to do a given amount of work; and

Coefficient of fatigue $= \frac{(A_1 - A_2) \times 100,}{A_2}$ [5] when fatigue is measured as a function of the amount of work which can be done in a given time.

Further examination of the previous research disclosed two other methods of computing fatigue and that modifications of either one of them might prove to be satisfactory in their application to this study. Thorndike (3) demonstrated that during

[4] T_1 = The time required to do a given amount of work at the beginning of the work period.

T_2 = The time required to do a given amount of work at the end of the work period.

[5] A_1 = The amount of work which may be done in a given amount of time at the beginning of the work period.

A_2 = The amount of work which may be done in a given amount of time at the end of the work period.

a period of freedom from continuous work which has produced mental fatigue, the value of the practice afforded by the work is retained and the effect of fatigue is lost. He pointed out that the amount of fatigue which has developed might be calculated by measuring the percentage which the time taken to multiply certain numbers of examples at the end of a work period is of that after several hours of rest succeeding the work period. The second of these methods was offered by Lindley (4), who assumed that the effect of practice is lost if extended over too long a period of time and that the effect of fatigue is retained if the rest period is of too short duration. He suggested that a number of trial rest periods of various lengths be introduced to determine the rest period providing the greatest possible loss of fatigue with the least amount of loss of practice.

The author felt that although the subject had previously been instructed in the method of solution of the analogies, that he would at the same time benefit by the practice afforded him during the 10-minute period of work and be inhibited by the developing fatigue. If a 5-minute rest period were permitted to follow this, the influence of the previous practice would be retained and the fatigue which had developed would disappear. It was found possible, by continuing the same kind of work for three minutes at the conclusion of the rest period, to compare both the rate of performance and the percentage of error during a corresponding number of minutes before and after the rest period, in order to determine any change in efficiency which might have taken place. Increased efficiency following the rest period might be inferred as an index of the fatigue developed during the first work periods. Two formulae were used in the computation of percentage of fatigue. One represents percentage of decrement of the number of problems solved per minute and the other, percentage of decrement in errors per minute. Both follow in the same order:

$$\text{Percentage of decrement} = \frac{(N/M_2 - N/M_1) \times 100}{N/M_1}$$

$$\text{Percentage of decrement} = \frac{(PE/M_1 - PE/M_2) \times 100}{PE/M_1}$$

Since the problem involves a study of the influence of difficulty and homogeneity upon the development of mental fatigue, it was found that it was necessary to prepare a series of analogies which contained the element of difficulty; another, in which there was an absence of difficulty; a third, in which homogeneity was present; and a fourth, in which there was no homogeneity. Since it is impossible to have a series, which contained only one of these elements and was at the same time totally lacking in all of the others, it became apparent that it would be necessary to produce one series which was at the same time difficult and homogeneous; one which was difficult and heterogeneous; one which was relatively easy and homogeneous; and another which was relatively easy and heterogeneous. Since two levels of intelligence were being considered, corresponding sets of problems were made for each. The problems in many cases were selected from the 1932 edition of the American Council on Education Psychological Examination (5) and from the 1929 edition of the Henmon-Nelson Tests of Mental Ability (6). The others were devised by the author. The problems, in mixed order, were submitted to individuals of known intelligence ratings for solution. As a result of this procedure, they could be arranged in the order of difficulty and assembled into heterogeneous series. In order to introduce the factor of homogeneity, a single problem was rearranged repeatedly and the order of correct response so varied that it could be presented a great number of times with a marked degree of similarity and yet with the absence of repetition of identical problems.

[6] N/M_1 = Average number of problems solved during each minute of the three minute period preceding the rest period.

PE/M_1 = Average percentage of error during each minute of the three minute period preceding the rest period.

N/M_2 = Average number of problems solved during each minute of the three minute period following the rest period.

PE/M_2 = Average percentage of error during each minute of the three minute period following the rest period.

APPARATUS

A punchboard was constructed upon which sheets of visual analogies might be placed. Each sheet was made up of three rows of thirty-six problems. Each problem was further composed of seven symbols, four of which represented possible solutions. The punchboard was so planned that beneath each of the four symbols, which might be chosen by the subject as the correct response, was an opening. The base of the opening in every case was composed of copper. When the subject punched through the paper with a stylus he completed an electric circuit and caused a record to be made upon a strip of paper moving through a chronograph which was operated by a synchronous motor. By this method, the subject made a record of his choice of solution and an indication of the length of time required.

EXPERIMENTAL PROCEDURE

Each member of both groups worked under a different set of conditions on each of four days of work. The same procedure was followed on each day. The subject was shown several sample problems and instructed in their solution. He was told to look at the first two symbols and to discover by what change the first had formed the second. Having done this, he was asked to choose the one of the last four symbols which he believed represented a similar change from the third. When it was certain that the subject clearly understood the method of solution, he was seated before the punchboard upon which a work sheet had been placed. He was then given the metal stylus and told to contact an electrode with it until he was given a signal to begin. By making such contact, the subject caused a record of the time at which work was initiated to be made upon the chronograph tape. He was told not to work so fast that he might expect to commit a great number of errors nor to work exceedingly slowly. He was allowed to work for ten minutes, after which he was told to stop. However, care was taken to permit him to finish the problem upon

which he was working so that its partial solution would not give him an advantage after the rest period. During the five minute rest period, the subject was allowed to read, or talk, or amuse himself in any way other than by examining or discussing the problems. Following this, he again touched the stylus to the same electrode as before, before resuming work for three minutes.

Each work sheet was examined for errors by comparing it with a correctly marked master sheet. The chronograph tape was marked off into lengths representing one minute each. The number of problems solved during each minute was determined by counting the corresponding marks on the tape. From the ratio between problems done and errors committed per minute, it was possible to compute the percentage of error during each minute.

RESULTS OF EXPERIMENT I

This experiment is concerned with the influence of the homogeneity and the difficulty of continuous mental work upon the development of mental fatigue in college students of superior intelligence.

The data was treated in two ways with the aid of the formulae described above. This method provided the means for obtaining two different indices of fatigue for each condition; one based upon differences in the rate of performance, and the other upon differences in the quality of performance. As a result of this treatment it was found that continuous mental work which was at the same time homogeneous and difficult produced more fatigue than any of the other kinds of work, when fatigue was measured in terms of amount done. The next greatest amount of fatigue was produced by continuous homogeneous easy mental work. This was followed, in order, by the relative amounts of fatigue produced during heterogeneous easy and heterogeneous difficult mental work. When fatigue was measured in terms of changes in quality of performance, it was found that the same order was maintained except that, in this instance, homogeneous easy work resulted

in slightly greater fatigue than that produced by work which was homogeneous and difficult. This indicates that homogeneous work which is either difficult or easy produces marked fatigue. The coefficients of fatigue and their derivations are presented in Tables 1 and 2.

TABLE 1

Superior I.Q. Group. Coefficient of Fatigue. Problems per Minute

Condition	M_1	SD_1	PE_1	M_2	SD_2	PE_2	M_2-M_1	PE	CR	CF
D.M.	4.09	1.55	0.087	5.87	2.11	.120	1.78	.140	12.70	43.5
D.H.	4.10	1.79	0.103	4.50	1.44	.08[illegible]	0.40	.106	3.77	9.7
E.M.	7.90	3.02	0.145	9.80	3.14	.182	1.90	.230	8.26	24.1
E.H.	5.80	1.89	0.108	6.60	2.56	.147	0.80	.190	4.20	13.7

TABLE 2

Superior I.Q. Group. Coefficient of Fatigue. Errors per Problem per Minute

Condition	M_1	SD	PE	M_2	SD	PE	M_2-M_1	PE	CR	CF
D.M.	21.9	21.4	2.08	16.3	14.3	1.39	5.6	2.50	2.24	25.5
D.H.	21.7	15.5	1.5	26.3	17.5	1.71	4.6	2.40	1.91	21.9
E.M.	6.7	7.4	0.72	4.7	7.2	0.70	2.0	1.00	2.00	29.8
E.H.	15.3	11.9	1.15	12.5	8.6	0.83	3.4	1.40	2.42	22.2

D.M. = Difficult homogeneous condition.
D.H. = Difficult heterogeneous condition.
E.M. = Easy homogeneous condition.
E.H. = Easy heterogeneous condition.
M_1 = Average number problems per minute before rest.
M_2 = Average number of problems per minute after rest.
PE_1 = Probable error of M_1.
PE_2 = Probable error of M_2.
SD = Standard deviation.
CR = Critical ratio.
CF = Coefficient of fatigue.

The relative importance of homogeneity and of difficulty may be clearly shown by comparing the average amount of fatigue developed in both homogeneous conditions with the

average amount developed in both heterogeneous conditions. The former was found to yield a fatigue decrement whose size is indicated by an average increase of 33.7 per cent in problems per minute and an average decrease of 27.6 per cent in errors per problem per minute following the rest period. The latter, on the contrary, showed only a very slight decrement indicated by an increase of 11.7 per cent in problems per minute and a decrease of 0.15 per cent in accuracy after the rest. This can leave no doubt concerning the greater influence exerted by homogeneity upon the development of fatigue. A similar procedure was followed in an attempt to discover the importance of difficulty as contrasted with easiness. It was found that, when fatigue was measured in terms of the quantity of performance, work involving the two difficult conditions produced an average increase of efficiency of 26.6 per cent while in the absence of difficulty the average increase was 19.4 per cent. When quality of performance was used to determine the coefficient of fatigue it was found that difficult work was accompanied by a decrement of 26 per cent and easiness by one of 1.8 per cent. This may be interpreted as meaning that neither difficulty nor easiness is of greater importance in the establishment of mental fatigue in the group of superior individuals studied.

RESULTS OF EXPERIMENT II

This experiment is identical with the other except that college students of normal intelligence acted as subjects and work sheets of less difficulty were used. As in the other, the data were treated in such a manner that two different indices of fatigue were obtained for each condition. It was found that the two homogeneous conditions produced fatigue to a greater extent than that produced by work containing the factor of heterogeneity. It was found, also that difficult work in the absence of homogeneity produced but little fatigue. These factors are presented in Tables 3 and 4.

When coefficients of fatigue representing the homogeneous and heterogeneous conditions were compared, it was found for

TABLE 3

Normal I.Q. Group. Coefficient of Fatigue. Problems per Minute

Condition	M_1	SD_1	PE_1	M_2	SD_2	PE_2	M_2-M_1	PE	CR	CF
D.M.	5.76	2.55	0.169	7.13	2.33	0.15	1.37	0.22	6.08	23.7
D.H.	5.44	2.87	0.190	5.89	3.22	0.21	0.45	0.28	1.60	6.2
E.H.	8.86	2.90	0.190	11.46	4.17	0.27	2.58	0.34	7.58	29.0
E.M.	10.60	3.51	0.230	14.10	4.74	0.31	3.50	0.39	8.90	33.0

TABLE 4

Normal I.Q. Group. Coefficient of Fatigue. Errors per Problem per Minute

Condition	M_1	SD	PE	M_2	SD	PE	M_2-M_1	PE	CR	CF
D.M.	18.5	13.8	1.56	9.3	12.4	1.40	−9.5	2.09	4.68	−51.3
D.H.	33.1	20.6	2.28	28.3	16.6	1.88	−4.8	2.95	1.62	−14.5
E.H.	12.6	21.1	2.44	8.1	9.5	1.19	−4.5	2.13	2.14	−35.7
E.M.	7.1	6.6	0.75	5.5	6.8	0.75	−1.6	0.33	4.70	−22.5

the former that on the basis of problems solved per minute, the average percentage of increase after the rest period was 28.4. For the other, the average was found to be 18.6 per cent. On the basis of errors per problem per minute, the corresponding results were 39.9 per cent for homogeneous material and 25.1 per cent for heterogeneous.

When the factors of difficulty and easiness were compared, it was seen that continuous mental work of relatively little difficulty was accompanied by the development of greater fatigue than in the presence of work which was more difficult, when fatigue was measured in terms of the quantity of work done. This is shown by an average coefficient of 31.0 per cent for easy work and one of 15.9 per cent for difficult work. When the coefficients were computed on the basis of accuracy the reverse was found to be true. Easy work was accompanied by an index of 22.9 per cent and difficult by one of 34.1 per cent.

In general the results obtained from the work of the members of the normal group show that fatigue is produced in the

presence of continuous homogeneous mental work. They show further that greater fatigue fails to develop either in the presence or in the absence of difficulty.

CONCLUSIONS AND INTERPRETATIONS

As a result of the procedure followed and the data obtained, it is apparently true that continuous homogenous mental work is accompanied by the development of diminished capacity to perform the same task. This is true for both individuals of superior intelligence and of normal intelligence. The results further indicate that mental work accompanied by difficulty or easiness, in the absence of homogeneity produces, in general, less fatigue than in the presence of homogeneity. It is important, also, to notice that in those conditions, in which mental work was difficult but heterogeneous, there was less fatigue developed than in any of the other conditions. This occurs in both the superior and in the normal group.

The conclusions of this experiment may be interpreted in terms of the principle of homogeneity which was established by Dodge and which has been supported by Robinson (7), Thorndike (8), Poffenberger (9), Bills (10) and others. These results fail to give support to the principle of difficulty which has been assumed to exist by Woodworth (11) and supported by Dodge (12) and others.

The fact that homogeneous mental work, whether accompanied by difficulty or not, brought about mental fatigue in this study indicates that it is true that the repetitive stimulation of a particular mental process is an active principle of mental fatigue. This may be further demonstrated by the fact that even when as large a number of heterogeneous problems were solved per minute as homogeneous ones, very little fatigue developed. This is explainable in terms of the number of different kinds of elements present in the problems. Homogeneous problems, while actually made up of the same number of elements, did not offer the possibility for the stimulation of as many different mental processes as those which

contained more diverse elements. This accounts both for a reduced rate of stimulation by heterogeneous work and for opportunity for greater recovery from previous functioning of a given stimulus response connection.

As a further development of this problem several possible experimental approaches present themselves.

The present experiment might be repeated among individuals of less than normal intelligence in order to find whether or not homogeneity and difficulty operate as fatigue principles at that level. In such an experiment, the problems involving reasoning by analogy would have to be reduced in difficulty in order to correspond to the abilities of the subjects.

In order to further test difficulty as a principle of the work decrement, an experiment might be undertaken which is concerned with the development of mental fatigue in the presence and absence of difficulty, measured in some other manner than employed in this study.

A highly important aspect of the present experiment would be one in which blocking as a principle of fatigue were related to the complex mental process of reasoning by analogy.

A study of some importance to education would be one in which the effect were noted of mental fatigue established by one kind of mental work upon the ability to carry out some other kind of mental work.

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A PLAN FOR USING PUNCHED CARDS IN PRESENTING TEST RESULTS IN PROFILE FORM

WILLIAM J. E. CRISSY AND JOHN C. FLANAGAN
Cooperative Test Service

THE problem of presenting test results in easily interpretable form has become increasingly important with the shift in emphasis that is taking place in mental and educational measurement. Psychologists, counselors, and personnel officers find that measures of specific traits are more useful than single indices of attainment or ability in general areas.

An illustration of this trend is found in a recent publication[1] by Dr. T. L. Kelley in which he calls attention to the need for identifying traits of personal and social significance and obtaining adequate measures of them. He strongly emphasizes the necessity for taking cognizance of the individual's *pattern* of talents and warns of the danger of covering up these individual differences in an over-all score. He recommends the presentation of test results in profile form.

If a clear and accurate graphic presentation of test results is to be made, scores on the tests used must be reported on a common scale on which a specific score indicates a comparable degree of excellence for any one of the various tests. In connection with the reporting of results in most large testing programs, certain additional requirements are generally imposed. The test scores must be reported (1) quickly, (2) inexpensively, and (3) in convenient form for permanent filing.

[1] Kelley, Truman L., *Talents and Tasks: Their Conjunction in a Democracy for Wholesome Living and National Defense.* Harvard Education Papers, No. 1. Cambridge, Mass.: Graduate School of Education, Harvard University, 1940, 48 p.

This article presents a method developed by the writers for graphic presentation of test results in a form that attempts to meet these requirements. The problem that confronted the writers was the development of a feasible plan by which to report the test results of the National Teacher Examinations of the American Council on Education. It was necessary to report a maximum of 15 scores for each examinee. Scores on the following tests were reported for each candidate:

(1) Reasoning
(2) English Comprehension
(3) English Expression
(4) Current Social Problems
(5) History and Social Studies
(6) Literature
(7) Science
(8) Fine Arts
(9) Mathematics
(10) Professional Information
(11) Contemporary Affairs
(12) General Culture Total, a sum of scores of (4) to (9) inclusive
(13) Common Examination Total, a weighted total including scores for (1) to (11) inclusive

In addition to the above scores, most candidates had scores on one or two optional examinations in their specific teaching fields from among the following ten optional tests:

(a) Education in the Elementary School
(b) English Language and Literature
(c) Social Studies
(d) Mathematics
(e) Biological Sciences
(f) Physical Sciences
(g) Spanish
(h) French
(i) German
(j) Latin

The General Culture Total and the Common Examination Total were three-digit scores; all others were two-digit scores. All the two-digit scores were Scaled Scores[2] and the Common Examination Total was so computed that it was approximately comparable to the Scaled Scores. To simplify interpretation, certain descriptive categories were assigned to appropriate score values, as indicated below.

Scaled Score Value	*Descriptive Category*
80 or above	Exceptional
70 to 80	Superior
60	Average for National Teacher Examination Candidates
50	Expected Average for Unselected Individuals
Below 50	Below Average

The Scale was so designed that the standard deviation of the unselected population was 10.

This paper presents a description of the Profile Card together with the necessary procedures for utilizing this type of report. Other statistical and tabulating procedures connected with the program will not be discussed.

THE TEST PROFILE CARD[3]

Figure 1 illustrates the front of the Profile Card. Persons taking the National Teacher Examinations fill in six of these cards at the first testing session. It will be noted that the card contains spaces for various information including an address. The examinee addresses one card to himself, one to a school system which he designates to receive his report, and one to a college he has attended.[4] The other three cards are not ad-

[2] Flanagan, John C., *The Cooperative Achievement Tests: A Bulletin Reporting the Basic Principles and Procedures Used in the Development of Their System of Scaled Scores.* Cooperative Test Service of the American Council on Education, 15 Amsterdam Avenue, New York, N. Y., December, 1939.

[3] Form used for 1941 National Teacher Examinations.

[4] If the candidate does not wish reports sent to such places, only one card is addressed.

dressed and they are used by the central office of the National Teacher Examinations to fill the examinee's future requests for reports.

Figure 2 shows a Profile Card after it has been filled in by the candidate and has been punched and interpreted. The number in the upper left corner is the candidate's number interpreted (printed) from punched holes. The remainder of the upper edge of the card contains the candidate's scores on the tests he has taken.

The profile side of the card before it has been punched is shown in Figure 3. A vertical scale appears above the name of each test. At the left of the scales are the descriptive categories referred to previously. The explanation at the left of the profile is supplemented by a four-page interpretative and normative leaflet.

Figure 4 is the profile side of the sample card illustrated in Figure 2 and shows the punching corresponding to the scores on the front. The last digit of each score (tens place or hundreds place) is now punched in the appropriate place on each scale. The holes on the scales are directly interpretable in terms of the categories at the left. For example, in the illustration the candidate's score on Reasoning is "Superior," his score on Science is "Exceptional," his score on the Common Examination Total is "Average for National Teacher Examination Candidates."

THE USE AND INTERPRETATION OF THE TEST PROFILE CARD

The Profile Card is intended for use as a report of test scores to the candidate and to other persons specified by him. Scores on all tests are printed on the front of the card (see Figure 2). As has been noted previously, an interpretative leaflet is also sent with these cards, and contains normative data by which the candidate's status on each of the examinations may be determined.

As shown in Figure 4, the back of the card presents a profile of the candidate's scores. The holes punched in the vertical

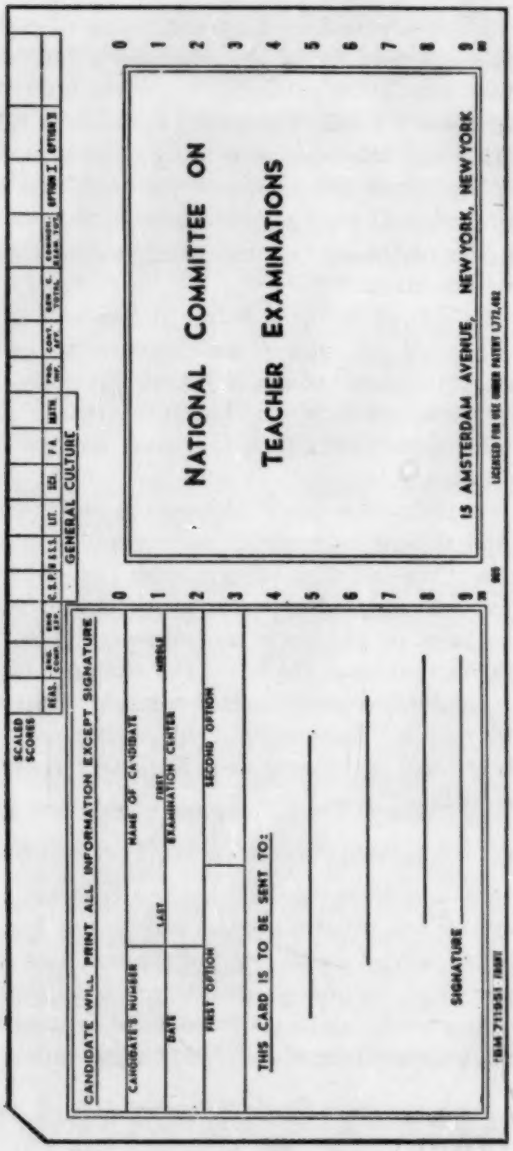
SCALED SCORES
READ.
PRO. CONC.
SPEL.
S.S.P.
ARITH.
LIT.
SCI.
F.A.
MATH.
PROB. SOLV.
CONST. APPR.
GEN. C. TOTAL
COMPOS. READ. TOTAL
OPTION I
OPTION II
GENERAL CULTURE
NATIONAL COMMITTEE ON
TEACHER EXAMINATIONS
15 AMSTERDAM AVENUE, NEW YORK, NEW YORK
CANDIDATE WILL PRINT ALL INFORMATION EXCEPT SIGNATURE
CANDIDATE'S NUMBER
NAME OF CANDIDATE
LAST
FIRST
MIDDLE
DATE
EXAMINATION CENTER
FIRST OPTION
SECOND OPTION
THIS CARD IS TO BE SENT TO:
SIGNATURE

FIG. 1.

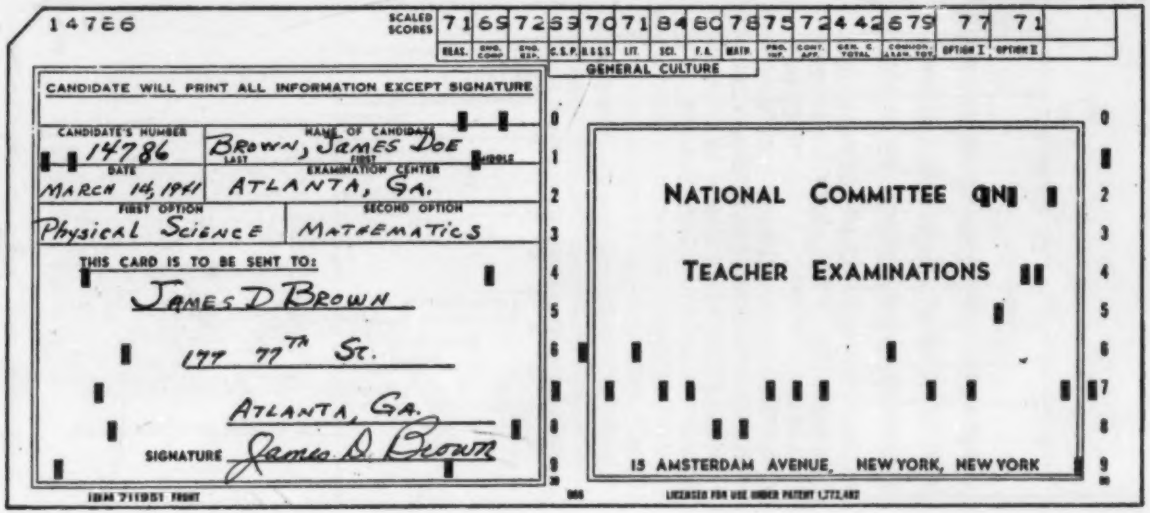
14786
SCALED SCORES
71 69 72 53 70 71 84 60 78 75 72 44 26 79 77 71
REAS. ENG. COMP ENG. REP. C.S.P. H.S.S.S. LIT. SCI. F.A. MATH. PROG. INF. COMP. APP. GEN. C TOTAL COMMON A.S.M. TOT. OPTION I OPTION II
GENERAL CULTURE
CANDIDATE WILL PRINT ALL INFORMATION EXCEPT SIGNATURE
CANDIDATE'S NUMBER 14786
NAME OF CANDIDATE BROWN, JAMES DOE
LAST FIRST MIDDLE
DATE MARCH 14, 1941
EXAMINATION CENTER ATLANTA, GA.
FIRST OPTION Physical Science
SECOND OPTION MATHEMATICS
THIS CARD IS TO BE SENT TO:
JAMES D BROWN
177 77TH St.
ATLANTA, GA.
SIGNATURE James D. Brown
NATIONAL COMMITTEE ON
TEACHER EXAMINATIONS
15 AMSTERDAM AVENUE, NEW YORK, NEW YORK
IBM 711951 FRONT
LICENSED FOR USE UNDER PATENT 1,772,482

Fig. 2.

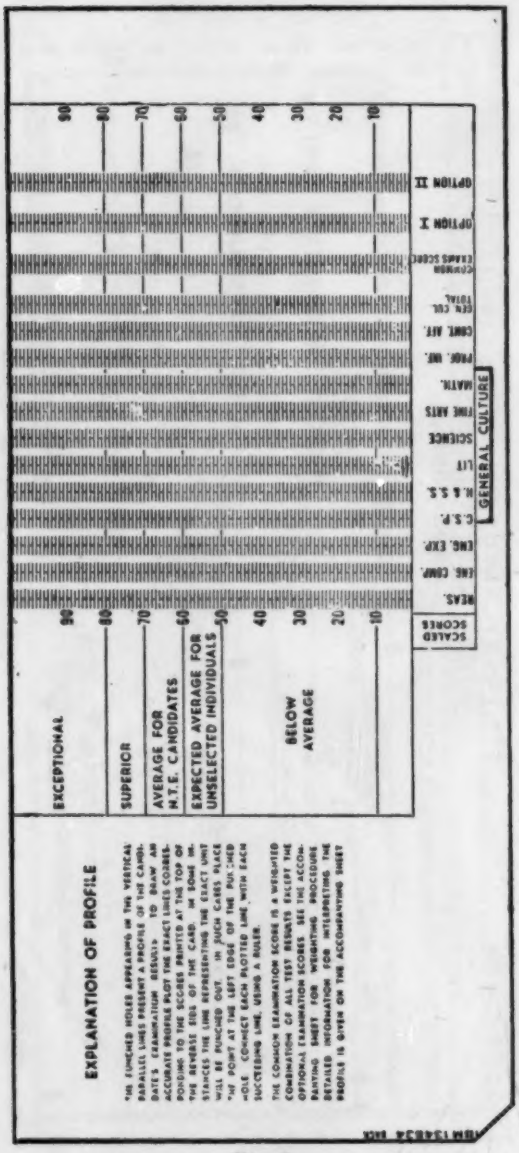
EXPLANATION OF PROFILE
THE PUNCHED HOLES APPEARING IN TWO VERTICAL PARALLEL LINES EITHER A PROFILE OF THE CANDIDATE'S TEST RESULTS. TO DRAW AN ACCURATE PROFILE PLOT THE EXACT LINES CORRESPONDING TO THE SCORES PRINTED AT THE TOP OF THE REVERSE SIDE OF THE CARD. IN SOME INSTANCES THE LINE REPRESENTING THE EXACT UNIT WILL BE PUNCHED OUT. IN SUCH CASES PLACE THE POINT AT THE LEFT EDGE OF THE PUNCHED HOLE CONNECT EACH PLOTTED LINE WITH EACH SUCCEEDING LINE, USING A RULER.
THE COMMON EXAMINATION SCORE IS A WEIGHTED COMBINATION OF ALL TEST RESULTS EXCEPT THE OPTIONAL EXAMINATION SCORES. SEE THE ACCOMPANYING SHEET FOR WEIGHTING PROCEDURE. DETAILED INFORMATION FOR INTERPRETING THE PROFILE IS GIVEN ON THE ACCOMPANYING SHEET
EXCEPTIONAL
SUPERIOR
AVERAGE FOR M.T.E. CANDIDATES
EXPECTED AVERAGE FOR UNSELECTED INDIVIDUALS
BELOW AVERAGE
90
80
70
60
50
40
30
20
10
SCALED SCORES
MEAS.
ENG. COMP.
ENG. EXP.
C.S.P.
M. & S.S.
LIT
SCIENCE
FINE ARTS
MATH.
PROF. INT.
GENL. APT.
GEN. CUL. TOTAL
COMMON EXAMS SCORE
OPTION I
OPTION II
GENERAL CULTURE

FIG. 3.

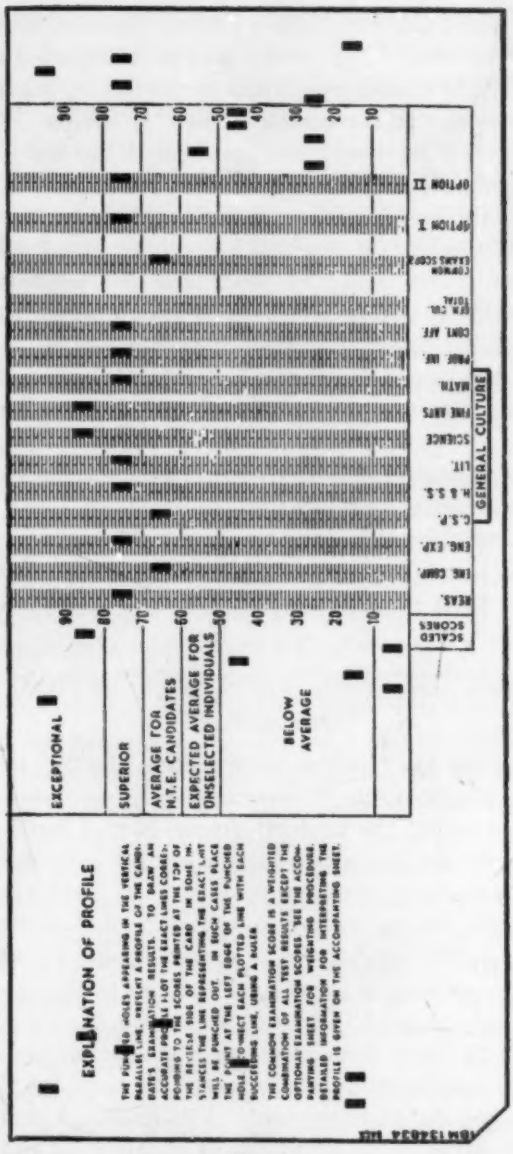
EXCEPTIONAL
SUPERIOR
AVERAGE FOR N.T.E. CANDIDATES
EXPECTED AVERAGE FOR UNSELECTED INDIVIDUALS
BELOW AVERAGE
90
80
70
60
50
40
30
20
10
SCALED SCORES
READ.
LAN. COMP.
ENG. EXP.
C.S.P.
H. & S.S.
LIT.
SCIENCE
FINE ARTS
MATH.
PROF. INF.
CONT. AFF.
OTH. CH. TOTAL
COMMON EXAMS SCORE
OPTION I
OPTION II
GENERAL CULTURE
EXPLANATION OF PROFILE
THE PUNCHED HOLES APPEARING IN THE VERTICAL PARALLEL LINE, PRESENT A PROFILE OF THE CANDIDATE'S SCALED TEST RESULTS. TO PLOT AN ACCURATE PROFILE, CONNECT THE EXACT LINES CORRESPONDING TO THE SCORES PRINTED AT THE TOP OF THE REVERSE SIDE OF THE CARD. IN SOME INSTANCES THE LINE REPRESENTING THE EXACT UNIT WILL BE PUNCHED OUT. IN SUCH CASES PLACE THE POINT AT THE LEFT EDGE OF THE PUNCHED HOLE AND CONNECT EACH PLOTTED LINE WITH EACH SUCCEEDING LINE, USING A RULER.
THE COMMON EXAMINATION SCORE IS A WEIGHTED COMBINATION OF ALL TEST RESULTS EXCEPT THE OPTIONAL EXAMINATION SCORES. SEE THE ACCOMPANYING SHEET FOR WEIGHTING PROCEDURE. DETAILED INFORMATION FOR INTERPRETING THE PROFILE IS GIVEN ON THE ACCOMPANYING SHEET.

FIG. 4.

scales represent the candidate's relative level of achievement on each of the tests. This profile may be interpreted by means of the descriptive categories listed at the left of the scale, and also by reference to the norms leaflet. If desired, the candidate may plot a more accurate profile since the scales are calibrated to provide for plotting each score to two digits. For most purposes, however, the punched profile is sufficiently accurate. The candidate may also plot, on his own Profile Card, the average scores made by candidates for positions in his teaching fields as well as for the total group taking the examinations. When these normative data are plotted, a basis is provided for interpreting the individual's scores in terms which have direct meaning to him and to his possible employers.

The school superintendent receiving such Profile Cards may make interpretations similar to those described above. In addition, he may use the cards for statistical analysis on tabulating equipment. A copy of the card layout is sent to superintendents upon request, so that they may easily utilize the cards in this way.

OTHER APPLICATIONS OF PUNCHED CARDS IN THE PREPARATION OF TEST PROFILES

This problem has received the attention of other workers in the field. Mr. English of International Business Machines Corporation called the writers' attention to a hand-punched card using the ten numeric positions in each column to report decile equivalents of raw scores. This may have an application in small testing programs where limited equipment is available. Joliffe and Lindquist are developing a Profile Card in which the scores are punched horizontal to the card layout and the resulting profile is in the form of a bar graph. This limits the number of tests which may be reported on one card to twelve. The resulting cards cannot be used for statistical analysis on tabulating equipment. Their method of reporting, however, is particularly adaptable to longitudinal testing pro-

grams where the group dealt with is retested each year and a new report is issued annually to each examinee. Each later report may be superimposed upon the previous one to provide graphically an index of growth.

The helpful suggestions received by the writers and the continued efforts of persons interested in this problem should result in the development of graphic reporting procedures which will make a genuine contribution to this phase of tests and measurements work.

APPENDIX

PROCEDURES FOR PUNCHING AND INTERPRETING THE PROFILE CARD[5]

The data which must be added to the card after the candidate has filled in the spaces on the front of the card are: (1) candidate's number (2) candidate's scores. The steps involved in preparing the card after its receipt from the testing center follow.

1. By previous machine operations there is available a master card for each candidate containing the registration number, the scores, and other data such as name, code numbers of optional examinations, etc. From this deck of master cards is reproduced a new deck of cards (referred to hereafter as work cards) containing the candidate's number and all the scores of the candidate, each datum in a specified field or set of columns on the card. In the case of the scores the fields are planned so that the last digit (tens or hundreds place) of each score is punched to coincide with the proper vertical scale printed on the back of the card for that score. This requires that column spaces be left between these digits; it also requires that the unit places of the scores be punched in column sequence in two fields on the card neither of which will affect the reading of the test profile. Two such fields are specified and they account for the punched holes on either side of the profile as indicated in Figure 4.

2. This work card deck is then interpreted to facilitate the manual sorting operation indicated in step 4 below. (The

[5] As used for the 1941 National Teacher Examinations.

alphabetic interpreter was used because of the number of printing positions required for the registration number and scores.)

3. The work cards then have an x- or 11-punch gang-punched into each of three columns. (This provides a control as indicated in step 5 below.)

4. At this point, the registration number and scores interpreted on the work cards (step 2) can be read by clerks. The interpreted cards are now checked. After checking, the work cards are manually sorted in with the Profile Cards previously filled in by the candidates. The sequence of the new file of cards after this sorting operation is as follows: work card for Candidate 10001, six Profile Cards for Candidate 10001; work card for Candidate 10002, six Profile Cards for Candidate 10002; etc. This step had to be supervised and checked with great care to prevent spoilage of the Profile Cards which contain data filled in by the candidates.

5. All the data in the work cards are now punched column for column into the Profile Cards by means of the gang-punch. The three x-punches in the work cards furnish a triple control on the gang-punching. This is a departure from the usual procedure of having just one x-control; it requires having the gang-punch equipped with two additional x-pick-ups.

6. Step 5 is checked by running the cards through the double punch detector.

7. The work cards are now sorted out of the combined deck (step 4) on any one of the three columns containing the x-punch.

8. The Profile Cards are next put in the alphabetic interpreter and the registration numbers and scores are interpreted.

The Profile Cards are now complete and can be split into whatever decks are desired by using the collator for parallel sorting against a control deck and controlling both decks on registration number.

The above steps furnish a summary statement of how the Profile Cards may be prepared. The feature of having the

candidates address the cards facilitates prompt and inexpensive reporting since window-envelopes may be used to mail the test results to the persons who are to receive them.

This medium for reporting test results has many applications in large testing programs because of its low cost, speed, and clarity of presentation. Modifications are being made in the reporting procedures described in this paper. It may be feasible to utilize the recently developed mark-sensing cards and equipment in connection with the use of such Profile Cards. Other simplifications should be possible by utilizing the factory facilities for prepunching and preprinting individual and card numbers.

NEWS AND NOTES

CONSERVATION OF SCHOLARLY JOURNALS

The American Library Association created this last year the Committee on Aid to Libraries in War Areas, headed by John R. Russell, the Librarian of the University of Rochester. The Committee is faced with numerous serious problems and hopes that American scholars and scientists will be of considerable aid in the solution of one of these problems.

One of the most difficult tasks in library reconstruction after the first World War was that of completing foreign institutional sets of American scholarly, scientific, and technical periodicals. The attempt to avoid a duplication of that situation is now the concern of the Committee.

Many sets of journals will be broken by the financial inability of the institutions to renew subscriptions. As far as possible they will be completed from a stock of periodicals being purchased by the Committee. Many more will have been broken through mail difficulties and loss of shipments, while still other sets will have disappeared in the destruction of libraries. The size of the eventual demand is impossible to estimate, but requests received by the Committee already give evidence that it will be enormous.

With an imminent paper shortage attempts are being made to collect old periodicals for pulp. Fearing this possible reduction in the already limited supply of scholarly and scientific journals, the Committee hopes to enlist the cooperation of subscribers to this journal in preventing the sacrifice of this type of material to the pulp demand. It is scarcely necessary to mention the appreciation of foreign institutions and scholars for this activity.

Questions concerning the project or concerning the value of particular periodicals to the project should be directed to Wayne M. Hartwell, Executive Assistant to the Committee on Aid to Libraries in War Areas, Rush Rhees Library, University of Rochester, Rochester, New York.

The Editors of this Journal believe that it will be of special interest to many readers to learn of the availability of the reprint of an article published in the December 1941 issue by Dr. Bruce V. Moore entitled "Analysis of Results of Tests Administered to Men in Engineering Defense Training Courses." The 16-page article contains many graphs and tables showing comparisons and correlations between various tests given the members of engineering defense training courses. Copies may be ob-

tained by writing the Editor of this Journal, or Dr. B. V. Moore, Department of Education and Psychology, Pennsylvania State College, State College, Pa. Price of single copies, 20 cents; a half dozen copies, $1.00; special rates on larger quantities given upon request.

At the fifth annual professional conference and business meeting of the American Association for Applied Psychology, held at Northwestern University, Evanston, Illinois, September 1, 2 and 3, 1941, Dr. Walter V. Bingham was elected President for the year 1942. He was for a number of years a member of the teaching staff at Stevens Institute. He is now assisting the Army as Chairman of the Committee on Classification of Military Personnel and as Chief Psychologist of the Personnel Procedures Section of the Adjutant General's Office. Dr. Bingham guided the activities of the Committee on Classification of Personnel during the first World War from 1917–18 and later served in the Personnel Branch of the General Staff with the rank of Lieutenant Colonel.

The statements below are quoted from the report by John A. McGeoch for Section I, Psychology, of the American Association for the Advancement of Science which held its one hundred and tenth annual meeting in Dallas, Texas, December 29, 1941, to January 3, 1942. Reference may be made to the special issue of *Science* dated February 6, 1942.

Of special interest to psychologists was the Symposium organized by E. R. Hilgard on "Recent Advances in the Appraisal of Personality." Four different methods of appraising personality were reviewed by Pearl Bretnall, D. G. Humm, F. A. Pattie and Dael Wolfle. These were play and other expressive productions, paper and pencil tests, hypnosis and factorial analysis.

The joint symposium with a Section on Education, organized by A. W. Melton and H. H. Remmers, was devoted to the "Psychology of Learning and the Educative Process." The three psychologists, E. R. Hilgard, N. L. Munn and John A. McGeoch, were in complete agreement on the principles and data for psychology which are significant for education and on the practical interrelatedness of the two fields. The unanimity displayed constituted an important demonstration of the systematic integraion which has been developing in psychology.

From Education Harold F. Clark described an extensive and socially important experiment on the influence of diet on learning. Hyman Meltzer uniquely surveyed the relations between mental hygiene and the learning process. Both of these papers significantly illustrated the interrelation of education and psychology.

Carl M. Dallenbach, vice-president and chairman of the Section on Psychology made a scholarly address on "The Temperature Senses: Their History and Present Status," reviewing the development of research on

these senses and summarizing the results of recent research, with particular reference to the receptors involved.

E. J. Ashbaugh, vice-president and chairman of the Section on Education, presented the problems of learning to read, with illuminating reference to their relation to the construction of the language, the title of his address being "Education as Science and Art."

In view of the fact that in some states, for example Ohio, the problem of the certification of clinical psychologists is now being considered, the following statement by Dr. Wallin may have some significance in addition to the historical value.

NOTE ON THE ORIGIN OF THE CLINICAL SECTION OF THE PRESENT AMERICAN ASSOCIATION FOR APPLIED PSYCHOLOGY

Statements continue to appear in the psychological journals regarding the origin of the American Association of Clinical Psychologists which are not in all details completely correct. The following correction is made for the sake of the accuracy of the record.

In 1937 one writer stated that "the need for a professional organization had its inception in 1917 among psychologists in the United States Army during the World War and an association of clinical psychologists was formed." This year a statement appeared to the effect that in 1917, a "group of forty-five well known psychologists . . . met at Pittsburgh to discuss plans for the establishment of an American Association of Clinical Psychologists."

In point of fact, the work of the psychologists in the United States Army had little if anything to do with the establishment of the Association of Clinical Psychologists, because the organization of this association had been discussed by a few "clinical" psychologists for several years before the war broke out.[1] Moreover, none of the founders of the association (F. N. Maxfield, Leta Hollingworth, J. B. Miner, D. Mitchel, R. Pintner, Clara Schmidt and J. E. W. Wallin)[2] saw service in the Army. That the work of the psychologists in the Army stimulated the development of the application of psychology to problems of human engineering is undoubted. The group that organized the association consisted of only eight persons and not forty-five.

J. E. W. WALLIN.

[1] J. E. W. Wallin, "The Establishment of the Clinical Section of the American Psychological Association," *School and Society*, July 23, 1938, pp. 114–115.

[2] J. B. Miner, "The Significance and History of the Clinical Section of the A. P. A.," *The Psychological Exchange*, June, 1932, pp. 7–11.

PSYCHOLOGISTS CLUB OF THE SAN FRANCISCO BAY REGION

JANUARY 8, 1942

It is a rapidly spreading view that if mankind is ever to be freed from the recurring curse of war there must be some sort of super-national or

world power. It is no less accepted that if the resources of the world are to be equitably shared by its inhabitants a world organization of some kind will be needed for planning on a world-wide scale.

The creation of a stable and effective super-national power of any kind depends fundamentally on such psychologic factors as the motivations, attitudes, beliefs, and emotional conditionings connected with national and super-national concepts and entities. A study is needed for the techniques for bringing about required changes in stereotypes, loyalties, and symbols in respect to a super-national governmental organization.

These problems lie in the field of applied social psychology, and their solution should be the task and the contribution of psychologists in this critical period of world history.

Be it therefore resolved, That the Psychologists Club of the Bay Region adopt as its project during the war period the study of the psychologic factors involved in the creation and functioning of an international or world federation.

FERN MCGRATH, *Secretary*
(*Alto Psychologic Center*)

The Committee on Rural Education, affiliated with the American Country Life Association and supported by a grant from the Farm Foundation in Chicago, has recently inaugurated a Rural Education Series of leaflets devoted to the problems of schools in rural areas. The first bulletin of this series, prepared by Mr. Meredith W. Darlington, deals with *The Education of Rural Teachers in Service*. This problem of education-on-the-job is especially acute at the present time for the 300,000 teachers in small rural schools, first, because of the steady up-grading of professional preparation now being required by the various states; second, because of the fact that salaries have not increased proportionately with these new requirements. In view of these facts, the Committee on Rural Education recently inaugurated a project for the experimental development of a Field Service Course in Rural Education at the State Teachers College in Kirksville, Missouri. While final results are not yet available, enough has been realized during its first year of trial to show significant achievement over the more formal theoretical courses commonly provided by the Extension Departments of state teachers colleges and liberal arts institutions.

The State University of Nebraska has also developed a similar course of in-service education among the rural teachers and has become convinced of the great value of functional courses as contrasted with the more formal conventional instruction commonly offered in this field.

The Midwestern Psychological Association will hold its seventeenth annual meeting at Hotel Statler, St. Louis, Mo., on Friday and Saturday, May 1 and 2, 1942, under the presidency of Dr. J. P. Porter, of Ohio University. The title of his presidential address will be "Psychology and the Functional Integration of Human Behavior." The members of the department of psychology at Washington University will act as hosts, with Dr. J. P. Nafe as Chairman of the local committee. On account of the considerable distance of the university from housing facilities, all meetings will be held at the association headquarters, Hotel Statler, where special arrangements are being made.

BOOK REVIEWS

WOLFLE, DAEL. *Factor Analysis to 1940.* Published for the Psychometric Society by the University of Chicago Press.

The purpose of this monograph, as announced by the author, is to survey the literature pertaining to Factor-Analysis since Dodds' 1928 Review, and to provide a complete bibliography covering the period 1928–1940.

The first forty-three pages provide a general discussion of the various factor methods, the general reasoning, the principal results, the uses and limitations of factor-analysis, written for the general reader with little or no mathematical background. Following this, there is a bibliography of 530 titles and an index.

Throughout the general discussion references to the original sources are given so that anyone interested in following up some phase of the subject can easily find the references he needs. Those who are interested in the mathematical developments of the theory, or in the technique of making a factor analysis can find references to books and original memoirs on the subject.

It is unlikely that the reader who is unacquainted with factor-analysis and whose mathematical training is limited, could follow the discussion in detail. The reader can get some idea of what is attempted and how factor-analysis may be used in research. It must be remembered that the ideas and procedures involved cannot be reduced to language clearly understood by one unfamiilar with the algebraic theory of linear transformations in space of n dimensions.

It seems that certain matters could have been made easier. For example, in the beginning there is a brief summary of what are called the basic assumptions and definitions common to all methods of factor-analysis. Some of these are really theorems. Statement 3, on page 3, is but a special case of the formula at the bottom of page 4. It may have been easier for the general reader to follow the discussion in (4) on page 3, if the discussion had been limited to the simple statement that the score on any test is assumed to be a linear combination of the factor scores, giving examples of the algebraic equations, followed by an explanation of the symbols used and the unit of measurement adopted. However, these are minor comments and mathematicians and psychologists alike will appreciate the very definite service rendered by the author in bringing together in one place such an extensive bibliography, and in setting forth the basic assumptions on which the different methods are based.

EZEKIEL, MORDECAI. *Methods of Correlation Analysis.* (Second Edition.) John Wiley & Sons, New York.

This is a practical treatment of certain types of problems that confront the research worker in the fields of Social and Economic Statistics. It is not intended as a general text on Elementary Statistics, yet the treatment is complete enough for the practical application of the ideas presented. More complicated mathematical proofs of formulas are omitted or appear only in an appendix. While the mathematical preparation of the reader is not assumed to be more than an understanding of Elementary Algebra, it might be said that to follow the text with profit one should have had an introduction to Mathematical Statistics such as is given in any of the standard elementary texts on the subject.

The methods presented are "largely the joint product of researchers in the Bureau of Agricultural Economics of the United States Department of Agriculture." The Methods are illustrated by solutions of actual problems with attention being given to short cuts and labor saving devices. Some of the formulas, such as the formula for r the coefficient of correlation, could have been given in slightly better form for computation with a machine. The reviewer prefers the expression "mean deviation" to "average deviation." However, these are minor criticisms of a clearly written, usable text.

This is the second edition of a book that has been available for ten years, and incorporates many of the changes that have come about in that period, especially those having to do with interpretations of standard errors and the reliability of estimates. The book should prove valuable to workers in many different fields of statistics both as a guide in employing certain techniques and as a guide in the determination of types of problems to be investigated.

Among the many noteworthy features of the presentation is the following: Simple correlation is presented as a description of the interdependence of variables, rather than the mere calculation of coefficients. The emphasis is on the regression equation and estimating one variable from known values of the other variables involved. From the study of estimating equations we are led to the Coefficient of Correlation and the Index of Correlation as measures of the degree of accuracy of the estimate given by the estimating equation.

The main text closes with a chapter on The Types of Problems to which Correlation Analysis has been Applied, and a chapter on the Place of Statistical Analysis in Research Work. There are five appendices giving the procedure for Calculating the Coefficient of Correlation for grouped data, the Doolittle solution of Normal Equations, Notes on Mathematical derivations of formulas, some nomographic charts for interpreting or adjusting Correlation Constants, a list of 103 important formulas, a glossary of symbols used, and a short bibliography containing references not otherwise listed in footnotes found throughout the text.

The printing is good and charts and tables are presented clearly and simply so that the text can be followed with a minimum of effort.

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CONKLIN, EDWIN G. (Editor in Chief). "Symposium on Recent Advances in Psychology." *Proceedings of the American Philosophical Society*, Vol. 84, No. 4, June, 1941.

Of the most enlightened nature was the *Symposium on Recent Advances in Psychology* by well-known psychologists who discussed the following topics before the American Philosophical Society in April, 1941. The topics and the men who discussed them are as follows:

Coalescence of Neurology and Psychology, Karl S. Lashley; *The Genesis of Behavior Form in Fetus and Infant*, Arnold Gesell; *On the Nature of Association*, Wolfgang Kohler; *Mental Abilities*, Edward L. Thorndike; *Psychoanalysis and Scientific Method*, Carney Landis; *Psychology and Defense*, Robert M. Yerkes; *Motivation Learning and Adjustment*, Edward C. Tolman.

Obviously no attempt will be made to integrate these widely diverging topics in this review.

Lashley offers evidence from a number of methodological approaches to show that neurophysiology and psychology are converging. He claims that perhaps the psychologist's chief contribution to the problem of brain-action and behavior is that "the characteristics of the mental can be stated meaningfully only as a structure of organization of elements which are themselves as purely conceptual as is the energy of physics." There is no need to seek fundamental differences between "mental" and "non-mental" brain; no need to look for any special form of energy correlating with the mind. What we need to seek are "correspondences of organization in physiological and mental processes."

Anatomical and physiological studies seem to indicate that the effect of cell action of the cortex is analogous to wave transmission on a liquid; that physical properties of cortex action following stimulation are quite different from reflex pathways. Electro-physiology supports the conception that psychological functions are largely independent of definite structural reflex pathways. Example offered is that "an object seen with one part of the retina is immediately recognized when its image falls on another part. . . ." Psychological action is not conditioned by specific anatomical areas alone. Lashley's own work with the operative technique on brain parts argue that "individual elements of the visual cortex are equivalent for visual reactions." Studies of perception by Gestalt psychologists indicate that the organization of sensory elements into perceptual patterns corresponds to physical laws governing cortex action.

Another point of convergence of physiology with psychology is shown in motivation. "Three variables have been shown to be involved in the

dominance of a pattern of behavior,'' says Lashley. They are, ''chemical activation,'' ''adequacy of the stimulus situation'' and ''the amount of available nervous tissue.'' Results offered in support of interrelationship of these three variables are: sexual drives can be initiated by injection of specific hormones; destruction of parts of the cerebral cortex may reduce sexual drives, and lastly, the excitability of a sex drive varies with the adequacy of stimulating conditions. Here we have chemical, environmental stimulation, and nervous tissue acting interchangeably.

The third point of convergence is revealed in the clinical studies of intellectual functions, such as aphasias. More recently, a new instrument, introduced by Spearman in England and advanced by Thurstone and others in this country, is that of factor analysis. These methods, while their approaches are different, are revealing that orthodox categories of both physiological and psychological concepts are having to be revised and as revision progresses there emerges the concept of interaction of cortical fields with the associated diverse psychological functions.

It is the recognition that ''mental'' has no characteristic properties other than organization that paves the way for a comparison of neurological and mental organization. If we recognize that physical organization has some of the characteristics of mental organization and that the latter converges toward physiological organization, we should see the relation of the two. This is Lashley's thesis. Goldstein, Cobb and others, following different leads are coming to the same general viewpoint that mind and body are not separate entities.

Gesell, in the Genesis of Behavior Form in Fetus and Infant, states that ''Form is the most ubiquitous of all scientific problems.'' The first task of genetic psychology is to identify the forms of the manifold reactions of the fetus, neonate and infant.

Gesell's paper in reality is a description of motion picture studies of the developmental patterns of infant behavior coming out of Yale University Clinic. For Gesell, behavior is the ordered hierarchical continuity of anatomical organization. This maturation from genes to maturity in man forces us to regard conditioning and learning, resulting in organized behavior, as ancillary rather than primary mechanisms. ''Mentation'' and psychic constitution must be approached from the standpoint of the dynamics of morphological development.

In answer to a request from the presiding officer regarding practical implications, Gesell suggests that developmental norms of the child may find application in clinical medicine, pediatrics, in neurology and in psychiatry.

Historically, there are three classes of associations, namely, ''contiguity,'' ''similarity'' and ''contrast.'' Proximity in time and space was, and is, essential to the establishment of a connection. But similarity is recall according to Kohler. Kohler points out that Thorndike claims items will be associated if they are experienced in a relation of ''mutual

belongingness.'' However, Kohler sees ambiguity in mere contiguity in the sense that *this goes with that*. He sees more than contiguity or proximity of items in space with their neural traces. He sees items near in space tending to unite more readily while under the influence of peripheral stimulation. Various processes of segments of the nervous system tend to interact. Resemblance then and proximity of items will be organized perceptually according to this *interaction principle* by virtue of arousing contiguous segments of the nervous system.

''The theory of learnnig and memory must assume that neural events which accompany primary experience do not entirely disappear when this experience vanishes. Aftereffects or traces are left in the nervous system,'' says Kohler. From these assumptions and the interaction principle Kohler deduced his theory of associations. If experiences are contiguous in the sense of associations, interaction between neural counterparts will be facilitated by the factor of proximity. Thus associations by contiguity hold because organization (perceptually and neurally) depends on proximity. In Kohler's theory proximity of items in association is essential because it favors interaction, for proximity is practically synonymous with contiguity. Whatever favors coherence of organized experience with its unitary trace favors association and retention and recall. Interaction is not independent of the interacting objects and processes. When things fit in and the interaction is completed equilibrium is obtained.

Associations, then, are aftereffects of specific organization or interaction. The perceptual organization has its accompanying neural organization. Hence, association is not just an indifferent bond between merely contiguous items. Experimental data are offered to support this theory.

No doubt some such dynamic relation exists in the association process. Whether it is just as Kohler suggests, further research alone can determine. His conception points toward a field theory rather than a reflex or an action potential theory.

Thorndike integrates trends in studies of mental abilities and shows that two lines of experimentation are advancing our concepts of abilities. One line of experimentation treats of training of abilities in one situation and transferring to another. The other line is of correlations or covariences of different manifestations of an ability. An example of this correlation technique is to determine whether the ablest boy in adding integers is necessarily the ablest in subtracting integers.

Thorndike defines mental ability as the probability that certain situations will evoke certain responses. An ability is defined in terms of tasks achieved or achievable. If the abilities are predictable in terms of tasks achieved, then the nature of the task is considered in relation to the ability. This gives rise to his concepts of abstract, concrete and social abilities. Correlation, not compensation, is found among these abilities. While Spearman's work emphasizes the finding of a common factor to all specific

abilities, nevertheless, it did stimulate the factor analysis of Kelley, Hotelling and Thurstone.

Thorndike touches upon the neural factors that underlie psychological abilities, but offers no answer to the relation between the two. In spite of Lashley's work, which may not hold for man, since every ability cooperates with one another, localization of function is still good brain physiology, according to Thorndike.

Landis, after commenting on the confusion of lay minds, concerning psychological analysis and psychoanalysis, states that psychoanalysis can be divided into three aspects—therapy, theory, and method. He claims Freud spent most of his time in trying to explain psychological phenomena revealed by therapy. His methods and techniques were identified with his therapy. Disregarding its meta-physical implications, psychoanalysis forced psychologists to inquire into early infant and childhood behavior. Secondly, psychoanalysis emphasizes the dynamic role of the unconscious. Thirdly, it called attention to sex and sexuality. Fourth, and lastly, psychoanalysis, by setting up a theory of personality objectionable to psychologists, forced them to study personality experimentally. This is a pointed discussion distinguishing between scientific psychology and psychoanalysis.

Yerkes states that while the United States developed the "Psychology of Defense" during the last World War, it immediately forgot the development and Germany, awakened to its possibilities as a means of waging war, began early to apply the psychological principles in rigid selection and training of men for the Nazi army. Consequently, human engineering took its place in the third Reich along with physical engineering.

The Nazi even built a central psychological institute in Berlin, the purpose of which was and is to develop research in the problems of propaganda, morale, personality analysis, and educational and industrial fatigue. Yerkes claims that psychologically we, as a nation, are ill-prepared for world conflict, (this was written before "Pearl Harbor" became a watchword), in spite of the fact that we have excellent developments going on in academic psychology.

Yerkes turns from Defense needs to psychology as a profession. It is his judgment that psychology should develop along the professional line comparable to medicine. It is his claim that it is one of the basic biological sciences, while psychiatry is only a special division of medicine. One phase of psychiatry, psychoanalysis, is woefully lacking. In this plea, that psychology is one of the basic divisions of biology and that *behavior-experience*, being an important part of biology, it should be developed in all phases of education, in vocational choice so that we may be competent socially and personally happy. If we viewed the subject matter in this light it would have wider influence both in peace and in war.

Under the topic of motivation, learning and adjustment, Tolman discusses four concepts: 1, drives; 2, values and valences; 3, beliefs; 4, frustration mechanisms.

The drives are treated under two heads, biological and social. The biological drives are divided into two aspects, *appetites* and *aversions*. Behaviorally, the identifying characteristic of a drive, according to Tolman, is the final consummatory response. The tissue need aspect of the drive (such as in hunger) is inferred from the consummatory reactions made toward objects and situations which satisfy the dominant drive. Tolman does not make the distinction between drive as a condition that releases energy and learned habits which may become their own drives.

Under aversions are cold-avoidance, heat-avoidance, danger-avoidance and frustration-avoidance, or getting from a state of "sufferance."

Social drives are gregariousness, loyalty to group, imitativeness, dominance and submission, etc. Any one of the above mentioned drive tensions endow the consummatory evoking situation with value. These values are positive and negative. But their positive and negative value are instrumental only. Final intrinsic values are inherent nowhere but in the "internal states" of the organism. Instrumental values are means or hindrances. Thus for Tolman internal states of satiation and *sufferance* alone are endowed with intrinsic value. He next turns to valence, a term used by Lewin as attraction value of a goal object. The attraction value of a goal object under normal conditions is independent of the inherent value of that object. Following valence is his concept of beliefs. Beliefs are of two kinds, instrumental and equivalent. The readiness of an individual to accept certain objects as means or hindrances relative to other objects or situations are "instrumental beliefs." Objects or situations as functionally equivalent are "equivalent beliefs." If and when situations give rise to irrational beliefs maladjustments follow. The situation that evokes *irrational beliefs* is usually one of frustration. Irrational traumatically held beliefs are equivalent to the Freudian mechanisms, such as "fixation," "displaced aggression," "group identification," "regressions," etc. From this analysis the author turns to group behavior of nations and comments on displaced aggressions and group identification, such as are shown in Nazi Germany and Fascist Italy. He sees evidence of some of these mechanisms beginning in America.

Tolman's paper is full of conceptual information of how the organism is motivated, how and why he learns and whether or not these motivations and acquired behavior patterns are adjustive.

All papers in this symposium by virtue of the necessary conditions imposed are over-simplifications in their attempts to generalize. Each paper represents an advance in psychology. Whether these advances are altogether representative of the many advances being made in psychology today, the reviewer is not competent to say. Advances they are, and recent ones. While all the papers are thought provoking, perhaps Lashley's, Kohler's and Tolman's manifest the most original thinking.

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NEW BOOKS AND PAMPHLETS

New books and pamphlets for review should be sent to James P. Porter, Editor, JOURNAL OF APPLIED PSYCHOLOGY, Ohio University, Athens, Ohio.

Addresses on Industrial Relations—1941. Bureau of Industrial Relations, Bulletin No. 13. JOHN W. REIGEL, Director. University of Michigan, Ann Arbor, Michigan, 1941. 93 pp.

Appraisal of Growth in Reading. I. WAYNE WRIGHTSTONE. Board of Education, New York City, November, 1941. No. 2. Educational Research Bulletin of the Bureau of Reference, Research and Statistics. 35 cents. 42 pp.

Boletine do Servico Social dos Menores. EDGAR SHALDERS. Diretoria do Servico Social Dos Menores, Sao Paulo, Brazil.

The Child Mind in Evolution. GERTRUDE HILDRETH. King's Crown Press, New York City.

College Sophomore Appraises His Curriculum. WILLIAM J. E. CRISSY AND DAVID G. RYANS. Cooperative Test Service of the American Council on Education. January, 1942, Series III, Vol. II, No. 2. 39 pp.

Contributions to a Psychology of Blindness. SAMUEL PERKINS HAYES. American Foundation for the Blind, Inc., New York, 1941. $2.50. 296 pp.

El Paso Schools Standard, Vol. 19, No. 2. Educational Press Association of America, El Paso, Texas. 52 pp.

A First Course in Statistics, Revised, with Study Manual. E. F. LINDQUIST. Houghton Mifflin, Boston, 1942. $2.50; Study Manual, $1.00. 242 pp.

Foundations for a Science of Personality. ANDRAS ANGYAL. The Commonwealth Fund, 41 E. 57th Street, New York, 1941. $2.25. 398 pp.

Fundamentals of Industrial Psychology. ALBERT WALTON. McGraw-Hill Book Company, New York, 1941. $2.00. 231 pp.

Fundamentals of Social Psychology. Third Edition. EMORY S. BOGARDUS. D. Appleton-Century Company, New York, 1942. $3.50. 538 pp.

Indian Education. Vol. I, No. 1, June, 1941. S. C. MITRA, Editor. University of Calcutta, Asutosh Building, Calcutta, India. 1 rupee and annas 8. 102 p.

Physiological Psychology. S. R. HATHAWAY. D. Appleton-Century Company, New York, 1942. $2.75. 335 pp.

Die Psychologische Marktforschung. DR. FRANZISKA-BAUMGARTEN-

TRAMER. Schweizerischen Zeitschrift fur Betriebswirtschaft und Arbeitagestaltung, Bern. 16 pp.

Reductions in Recidivism Through Therapy. RUTH JACOBS LEVY. Thomas Seltzer, Publisher, New York, 1941. $1.50. 143 pp.

Report of the President of Columbia University for 1941. Columbia University Press, Morningside Heights, New York. 60 pp.

Social Psychology, Introduction. MAURICE H. KROUT. Harper & Brothers, New York, 1942. 823 p.

Your Personality, Introvert or Extrovert? VIRGINIA CASE. The Macmillan Company, New York, 1941. $2.50. 277 pp.

Directory of American Psychological Periodicals

(*Continued*)

Journal of Comparative Psychology—Baltimore: The Williams & Wilkins Co. Subscription $7.00 per volume of 500 pages. Two volumes every year. Acting Managing Editor, Roy M. Dorcus. Founded 1921.

Comparative Psychology Monographs—Baltimore: Williams & Wilkins Co. Subscription $6.00. 400 pages per volume. Roy M. Dorcus, Managing Editor. Published without fixed dates, each number a single research. Founded 1922.

Genetic Psychology Monographs—Provincetown, Mass.: The Journal Press. Subscription $7.00 per volume. One volume per year. Edited by Carl Murchison and an international cooperating board. Quarterly. Each number one complete research. Child behavior, animal behavior and comparative psychology. Founded 1925.

Psychological Abstracts—Ohio State University, Columbus, Ohio: American Psychological Association. Subscription $7.00 a year ($7.25 foreign). 700 pages ann. Edited by W. S. Hunter. Monthly. Abstracts of psychological literature. Founded 1927.

Journal of Genetic Psychology—Provincetown, Mass.: The Journal Press. Subscription $14.00 per annum; $7.00 per volume. 1,000 pages annually (2 volumes). Edited by Carl Murchison and an international cooperating board. Quarterly. Child behavior, animal behavior, and comparative psychology. Founded 1891.

Journal of Social Psychology—Provincetown, Mass.: The Journal Press. Subscription $7.00. 500–600 pages annually. Edited by John Dewey, Carl Murchison, and an international cooperating board. Quarterly. Political, racial, and differential psychology. Founded 1929.

Personnel Journal—New York: The Personnel Research Federation. Subscription $3.00. 400 pages. Edited by Charles S. Slocombe. Published monthly, except July and August.

Mental Measurement Monographs—Baltimore: The Williams & Wilkins Company. Subscription $5.00. 400 pages annually. Edited by Knight Dunlap and Buford Johnson. Published without fixed dates, each number a single research. Founded 1925.

Studies in Psychology and Psychiatry—Baltimore: The Williams & Wilkins Company. Subscription $5.00. 400 pages annually. Edited by Edward A. Pace. Published without fixed dates, each number a single research. Founded 1926.

Journal of Educational Psychology—Baltimore, Md.: Warwick & York. Subscription $6.00. Edited by Jack W. Dunlap, Harold E. Jones, and Percival M. Symonds. Published monthly except June to August. Founded 1910.

Child Development—Baltimore, Md.: Williams & Wilkins Company. Subscription $5.00. 400 pages annually. Edited by Buford Johnson. Quarterly. Founded 1930.

Character and Personality—Durham, N. C.: Duke University Press. Subscription $3.00 per annum. Quarterly. Published simultaneously in Great Britain and the United States. Edited by Charles E. Spearman (London) and Karl Zener (Duke University). Founded 1932.

Journal of Psychology—Provincetown, Mass.: The Journal Press. Subscription $14.00 per annum; $7.00 per volume. 1000–1200 pages annually. Immediate publication for any accepted manuscript. Edited by Carl Murchison and an editorial board. Quarterly. The general field of psychology. Founded 1935.

Directory of American Psychological Periodicals

American Journal of Psychology—Ithaca, N. Y.: Cornell University. Subscription $3.50. 624 pages annually. Edited by E. M. Ballenbach, M. F. Washburn, M. Bentley, E. G. Boring. Quarterly. General and experimental psychology. Founded 1887.

Journal of General Psychology—Provincetown, Mass.: The Journal Press. Subscription $14.00 per annum; $7.00 per volume. 1000 pages annually (2 volumes). Edited by Carl Murchison and an international cooperating board. Quarterly. Experimental, theoretical, clinical, and historical psychology. Founded 1927.

Psychological Review—Ohio State University, Columbus, Ohio: Psychological Review Company. Subscription $5.50 (Foreign, $5.75). Single copies, $1.00. 540 pages annually. Bi-monthly. Original contributions only. Edited by Herbert S. Langfeld. Founded 1894.

Psychological Monographs—Ohio State University, Columbus, Ohio: Psychological Review Company. Subscription $6.00 per vol. 600 pages. Edited by John F. Dashiell. Published irregularly, each issue one or more researches. Founded 1895.

Psychological Bulletin—Ohio State University, Columbus, Ohio: Psychological Review Company. Subscription $6.00. [illegible] pages annually. Psychological literature. Monthly (10 numbers). Edited by John A. McGeoch. Founded 1904.

Archives of Psychology—New York: Columbia University. Subscription $6.00. 500 pp. ann. Ed. by R. S. Woodworth. Published without fixed dates, each number a single experimental study. Founded 1906.

Journal of Abnormal and Social Psychology—Ohio State University, Columbus, Ohio: American Psychological Association. Subscription $5.00. Foreign, $5.25. Editor, Gordon W. Allport. Quarterly. 560 pages annually. Abnormal and Social. Founded 1906.

Psychological Clinic—Philadelphia: Psychological Clinic Press. Subscription $3.00. 288 pages. Ed. by Lightner Witmer. Without fixed dates (Quarterly). Orthogenics, psychology, hygiene. Founded 1907.

Psychoanalytic Review—Washington, D. C.: 3617 16th St., N.W. Subscription $5.00. 500 pages annually. Psychoanalysis. Quarterly. Ed. by W. A. White and S. E. Jelliffe. Founded 1913.

Journal of Experimental Psychology—Ohio State University, Columbus, Ohio. Monthly, two volumes per year, each volume of six numbers containing about 500 pages. Experimental. Subscription $14.00 ($7.00 per volume). Edited by S. W. Fernberger. Founded 1916.

Journal of Applied Psychology—Lancaster, Pa.: Science Press Printing Co. Subscription $6.00. 600 pages annually. Bi-monthly. Edited by James P. Porter, Ohio University, Athens, Ohio. Founded 1917.

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